






# The protection of marine European Protected Species from injury and disturbance

Guidance for the marine area in England and Wales and the UK offshore marine area

By

Joint Nature Conservation Committee, Natural England and Countryside Council for Wales

June 2010

# Table of contents

# The protection of marine European Protected Species from injury and disturbance

Guidance for the marine area in England and Wales[i] and the UK offshore marine area[ii]

## Summary

This guidance is intended to provide a resource for marine users, regulators, advisors and the enforcement authorities when considering whether an offence of deliberately disturbing or injuring/killing a marine European Protected Species (EPS) is likely to occur or to have occurred as a result of an activity. Marine EPS include cetaceans (e.g. harbour porpoise), turtles and the Atlantic Sturgeon. Insofar as it provides guidance on the application of the disturbance offence, the guidance must be taken into account by courts in proceedings for that offence.

The guidance document illustrates a preventative approach to ensure the strict protection of EPS in their natural range as required by Article 12 of the Habitats Directive. It provides an interpretation of the offences of deliberate capture, injury, killing or disturbance of any wild animal of an EPS, under regulations 41(1)(a) and (b) in The Conservation of Habitats and Species Regulations 2010 ('HR') and 39(1)(a) and (b) in The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (amended in 2009 and 2010, 'OMR').

Disturbance and injury have the potential to occur as a result of certain activities in the marine environment. The guidance will help developers, regulators and courts assess:

a) the likelihood of an offence being committed;
b) how this can be avoided; and
c) if it can't be avoided, the conditions under which the activity could go ahead under licence.

The likelihood of an activity resulting in injury or disturbance to a marine EPS will very much depend on the characteristics of the activity, of the environment and the species concerned, hence the need for a case-by-case approach when assessing the risk of it occurring. Pursuing mitigation measures, alternative methods, locations and/or times for carrying out proposed activities might in some cases be sufficient to reduce the risk of causing offence to negligible levels. This would then negate the requirement for a licence.

*Interpretation of deliberate*

Section 1.2.1 of the guidance discusses the term 'deliberate' in the context of two European Court of Justice cases, which have been interpreted in guidance produced by the European Commission on the disturbance of EPS:

[i] Please refer to regulation 3(1) of the HR for a definition of the marine area in England and Wales.
[ii] Please refer to Part 1 of the OMR for a definition of offshore marine area and Part 3, regulation 33 for a clarification of the area to which the offences in part 3 apply (includes regulation 39).

"'*Deliberate' actions are to be understood as actions by a person who knows, in light of the relevant legislation that applies to the species involved, and the general information delivered to the public, that his action will most likely lead to an offence against a species, but intends this offence or, if not, consciously accepts the foreseeable results of his action*".

This interpretation is wider than we usually understand to be 'intentional action' under English and Welsh law, but is consistent with the meaning of the term under the Habitats Directive. Therefore, anyone carrying out certain activities which they should reasonably have known could cause injury or disturbance as in the regulations and as interpreted in this guidance could be committing an offence. The guidance makes it clear that by following appropriate mitigation measures and/or using alternative methods, the risk of certain activities causing an offence may be reduced to negligible levels.

*Interpretation of the injury offence*
Certain activities that produce loud sounds in areas where animals of an EPS could be present have the potential to result in an injury offence, unless appropriate mitigation measures are implemented to prevent the exposure of animals to sound levels capable of causing injury. Mitigation measures such as those presented in Annexes A, B and C of this document, when used appropriately and adequately, are likely to reduce the risk of an injury offence to negligible levels.

This guidance proposes that a permanent shift in the hearing thresholds (PTS) of an EPS would constitute an injury offence and suggests the use of the Southall *et al.* (2007) precautionary criteria for injury. These criteria are based on quantitative sound level and exposure thresholds over which PTS-onset could occur for different groups of species. If it is likely that an EPS could become exposed to sound at or above the levels proposed by Southall *et al.* (2007) then there is a risk that an injury offence could occur. The risk of an injury offence will be higher in areas where EPS occur frequently and/or in high densities.

*Interpretation of the disturbance offence*
The disturbance offence catches disturbance which is significant in that it is likely to be detrimental to the animals of an EPS or significantly affect their local abundance or distribution. Such disturbance could therefore be likely to increase the risk of a negative impact to a population of an EPS at Favourable Conservation Status (FCS) in their natural range. Sporadic disturbances without any likely negative impact on the animals, i.e. trivial disturbances such as that resulting in short term behavioural reactions, are not likely to result in an offence being committed.

It is difficult to prescribe quantitative sound level criteria for the onset of disturbance since the level of sound received by the animal does not seem to be the sole important aspect in determining the response and its significance. A disturbance offence is more likely where an activity causes persistent noise in an area for long periods of time. This guidance proposes that a disturbance offence is more likely to occur when there is a risk of:

a) animals incurring sustained or chronic disruption of behaviour scoring 5 or more in the Southall *et al.* (2007) 'behavioural response severity scale'; or
b) animals being displaced from the area, with redistribution significantly different from natural variation.

The risk of a disturbance offence being committed will therefore exist if there is sustained noise in an area and/or chronic noise exposure, as a result of an activity. This risk is likely to be higher in regions where there are semi-resident populations or where animals occur

frequently and in high densities. The risk will be negligible in areas where EPS are unlikely to occur, occur only occasionally, in small numbers and where individuals are unlikely to remain in the same area for long periods of time.

*Licensing and assessment*

The guidance also provides advice to the developer, regulator and nature conservation agencies on the licensing process to exempt from the offences, including the tests and assessments associated with the granting of a licence. If there is a risk of injury or disturbance of EPS that cannot be removed or sufficiently reduced by using alternatives and/or mitigation measures, then the activity may still be able to go ahead under licence, but this should be a last resort. A licence should only be granted if the activity fits certain purposes, if there is no satisfactory alternative and where the activity will not be detrimental to the maintenance of the populations of the species concerned at a FCS in their natural range.

*Activities*

Section 3 of the guidance lists all activities at sea that could potentially cause a deliberate injury or disturbance offence under the Regulations. Activities include: construction works; explosive use; military sonar; seismic surveys and whale-watching. A brief description is given of the activities with the potential to cause disturbance or injury, together with some information on the currently known spatio-temporal extent of the activity and the risk of committing an offence. The main concerns regarding disturbance and injury and evidence relating to those effects are highlighted, together with a review of gaps in the knowledge and active areas of research. Finally, for each activity, the existence or otherwise of good practice guidelines (mandatory or voluntary) is noted, together with their status and details of the organisations that are working on them. Some of these guidelines (seismic, pile driving and explosive use) can be found in Annexes to this document.

*Species*

Activities that are likely to be relevant to this guidance will have the potential to affect more than one species of cetacean, but a species-by-species approach is needed to determine whether a proposed activity is likely to result in an offence being committed. The main reason for this is that different species may have different sensitivities or reactions to the same potential disturbance factor, which must be taken into account when assessing the risk of an offence being committed. Section 4 summarises existing information on the distribution, population size estimates, conservation status and particular vulnerabilities of the species to which the regulations apply. These include cetacean species commonly occurring in UK waters such as the bottlenose dolphin, harbour porpoise, white-beaked dolphin and minke whale and also uncommon and vagrant species, as well as some species of turtles and the Atlantic sturgeon.

# Introduction

## *What is the purpose of this guidance?*

The guidance in this document is intended to provide a resource for marine users, regulators, advisors and the enforcement authorities when considering whether an offence of **disturbing** or **injuring/killing** a marine European Protected Species (EPS) is likely to occur or to have occurred as a result of an activity. The offences of injury/killing and disturbance may form part of a spectrum of potential effects caused by some activities, ranging from death to disturbance and to no effect.

## *What are European Protected Species?*

These are species which are listed in Annex IV(a) of the Habitats Directive and whose natural range includes any area in Great Britain. In UK waters, these consist of several species of cetaceans (whales, dolphins and porpoises) turtles, and the Atlantic Sturgeon[iii].

## *Legal Background*

Guidance in this document illustrates a preventative approach to ensure the strict protection of Annex IV(a) animal species in their natural range as required by Article 12 of the Habitats Directive. The European Commission (EC) issued guidance on the interpretation and application of Articles 12 and 16[1], which states in section II.2.1.14 (paragraph 14) that an adequate system of strict protection for such species consists in a set of coherent and coordinated measures of a preventive nature.

The Habitats Directive has been transposed into the law of England, Wales and Scotland by The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) and in Northern Ireland by The Conservation (Natural Habitats &c.) Regulations 1995 (as amended). In this document, the 1994 Regulations (and amendments and consolidations) are referred to as the 'Habitats Regulations' or 'HR'[iv]. Additionally, the Habitats Directive has been transposed into UK law for offshore oil and gas activities in The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended), and for all offshore activities including oil and gas in the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended in 2009 and 2010) (the 'Offshore Marine Regulations' or 'OMR'). The OMR cover offshore marine areas: those within UK jurisdiction, beyond 12 nautical miles (nm).

[iii] See too Schedule 2 of the Habitats Regulations at http://www.opsi.gov.uk/SI/si1994/Uksi_19942716_en_8.htm and amendments in http://www.opsi.gov.uk/si/si2007/pdf/uksi_20071843_en.pdf

[iv] The Conservation (Natural Habitats, &c.) Regulations 1994 (HR) have been amended five times. Firstly, in relation to Scotland, by the Conservation (Natural Habitats, &c) Amendment (Scotland) Regulations 2007 which came into force in 2007. The Conservation (Natural Habitats, &c) (Amendment) Regulations 2007, which came into force also in 2007, made similar, but not identical, amendments in relation to England and Wales. An amendment adding three new species was made in 2008. Further amendments were made in 2009: The Conservation (Natural Habitats, &c.) (Amendment) (England and Wales) Regulations 2009. In 2010 a consolidated version of the regulations came into force: The Conservation of Habitats and Species Regulations 2010. The guidance in the present document concentrates on the Habitats Regulations as they apply in England and Wales.

The HR and OMR prohibit the deliberate capture, injury, killing or disturbance of any wild animal of a European protected species (EPS), under regulations 41(1)(a) and (b) and 39(1)(a) and (b), respectively. Under regulations 41(1) (c) and (d) and 39(1) (c) and (d), of the HR and OMR respectively, it is also prohibited to deliberately take or destroy the eggs of an EPS and to damage or destroy, or do anything to cause the deterioration of, a breeding site or resting place of such an animal. These latter offences are not covered in this guidance (see "Scope of the guidance" below).

### *The need for guidance on the offences*

Following the amendments made to the HR and OMR in January 2009, the Regulations now more clearly transpose the requirement contained in the Habitats Directive to prohibit deliberate disturbance, and better reflect the circumstances in which disturbance may be particularly damaging to the animals concerned (and envisaged by Article 12). In addition, the HR and OMR provide for the offence of deliberate injury.

Neither the amended HR nor the OMR contain the 'incidental result' defence for activities that disturb or injure an EPS, a defence that was originally available under the HR for deliberate disturbance only. That defence is still available under the Wildlife and Countryside Act 1981 (WCA) for intentional or reckless injury and disturbance, providing the disturbance or injury occurred as an incidental result of an otherwise lawful activity and could not have been reasonably avoided.

This guidance is intended to help those carrying out activities in the marine environment assess:

a) the likelihood of an offence being committed as an incidental result of an otherwise lawful activity;
b) how this can be avoided; and
c) as a last resort, whether the activity could go ahead under licence**.**

In addition, the guidance includes advice on the interpretation of the following elements, for marine EPS:

1) the meaning of *deliberate*;
2) how to assess the likelihood of *injury*;
3) how to assess *disturbance* that would be considered likely to impair the ability of animals to survive, breed or reproduce, or rear or nurture their young, or migrate; and
4) how to assess whether the effects on the *local distribution or abundance* of a species could be *significant*;

The amendments made to the HR and OMR in January 2009 included a duty on courts to take account of any guidance produced by the statutory nature conservation bodies in relation to the regulations 41(1)(b) and (d) and 39(1)(b) and (d), of the HR and OMR respectively when considering an alleged offence under those regulations. Therefore this guidance is also intended for use by the courts. This is discussed further in the section on scope of the guidance, below.

Disturbance and injury have the potential to occur as a result of consented activities in the marine environment. However, the effective adoption of good practice guidelines (see Annexes) and, where necessary and possible, of alternatives/mitigation measures, as agreed with the nature conservation agencies, should, in many cases, reduce that risk. If, despite following guidelines and pursuing alternatives, an offence does unexpectedly occur and is proven, then the preventative actions that were taken would likely be relevant to the question of whether the action was 'deliberate' (see section 1.2. below).

The disturbance offence under the HR and OMR does not completely mirror the disturbance offence under Part 1, section 9 of the WCA. Part 1 of the WCA extends to the territorial waters adjacent to Great Britain, and certain marine species (including EPS) listed in Schedule 5 will also benefit from the protection of section 9. See Appendix I for further details on the context to the disturbance offence and the differences between the WCA and the HR.

## *Scope of the guidance*

*Statutory and non-statutory guidance*

This document contains:

- **Statutory** guidance on the offence of deliberate disturbance under regulations 41(1)(b) and 39(1)(b) of the HR and the OMR, respectively, for marine EPS only[v].
- **Non-statutory** guidance on the offence of deliberate capture, injury or killing under regulations 41(1)(a) and 39(1)(a) of the HR and the OMR, respectively.
- **Non-statutory** guidance on licensing under regulations 53 and 49, of the HR and OMR, respectively.

This guidance is published by the Joint Nature Conservation Committee (JNCC) under regulation 39(7) of the OMR, and by Natural England (NE) and Countryside Council for Wales (CCW) under regulation 41 (9) of the HR, on the application of the disturbance offence in regulation 41(1) (b) and 39(1) (b), respectively. Insofar as it provides guidance on the application of the disturbance offence, it must be taken into account by courts in proceedings for that offence. The guidance contained in this document on the disturbance offence has been approved by the Secretary of State (in relation to England and the UK offshore marine area, except offshore Scotland) and Welsh Ministers (in relation to Wales).

The guidance contained in this document on the injury offence and licensing regulations can (but is not required to) be taken into account by courts.

This document does not cover the offence set out in paragraph 41 (1)(d) of the HR ( "damages or destroys a breeding site or resting place of such an animal") and 39(1)(d) of the OMR ("damages or destroys, or does anything to cause the deterioration of, a breeding site or resting place of such an animal"). This is because current information for marine EPS in UK waters does not suggest the existence of such distinct sites, in contrast to terrestrial EPS. Similarly, this guidance also does not cover the offence in 41(1)(c) and 39(1)(c) of the HR and OMR ( "deliberately takes or destroys the eggs of such an animal") because the EPS currently found in the UK marine area are not known to produce eggs in these waters.

[v]Guidance on terrestrial EPS in England and Wales is being developed by NE and CCW

*Precautionary approach*

This guidance reflects a precautionary approach given the uncertainties surrounding the issue of disturbance and marine EPS. **It will be reviewed regularly** (every two years may be appropriate, at least initially) to ensure that it is kept up to date, relevant and appropriate. It is expected that knowledge of marine EPS in UK waters will increase with continued and improved surveillance and monitoring. This, together with a better understanding of the impact of activities on these species will be used to improve guidance. Feedback on the usefulness and applicability of the guidance will also be considered in future reviews.

*Species focus and separate terrestrial guidance*

The focus of this guidance is mainly on cetacean species, since these are the most common marine EPS occurring in UK waters. Nevertheless, the guidance can also apply to other marine EPS such as certain species of turtles and the Atlantic Sturgeon.

For terrestrial EPS (including otters) guidance is being developed by the relevant nature conservation agencies.

Incidental capture in fishing nets (by-catch) is considered a major direct threat to marine mammals throughout the world[2]. However, this is not covered in the current guidance since sea fishing in Member States waters is regulated within the framework of the Common Fisheries Policy, which includes provisions for the protection of these species from by-catch. It is considered that as long as fishing takes place in accordance with these provisions, it is unlikely that incidental capture would be viewed as deliberate.

*Structure*

Text boxes have been placed throughout chapters 1 and 2 of this guidance to aid the reader by summarising the key points. However, these should not be considered a substitute for the detail contained in the main body of the text.

*Application to territorial waters adjacent to Scotland and Northern Ireland*

**In the territorial waters** *adjacent to* **Scotland and Northern Ireland, the offences relating to the protection of marine EPS are slightly different and the guidance in this document is not necessarily applicable.** For guidance on the particular situation in each administration, or where there is any doubt as to the suitability of the guidance, please contact the following:

**Scotland:**
Scottish Natural Heritage
Great Glen House
Leachkin Road
Inverness
IV3 8NW
phone: 01463 725000

**Northern Ireland:**
Northern Ireland Environment Agency (NIEA)
Biodiversity Unit
Klondyke Building
Cromac Avenue, Gasworks Estate
Belfast
phone: 028 90569605

# 1. The offences and definitions

**Key points:**

- In inshore waters around England and Wales and in the UK offshore area, it is an offence to deliberately capture, kill or injure or to deliberately disturb animals of European Protected Species such as cetaceans, turtles and the Atlantic Sturgeon.
- The term 'deliberate' has been interpreted[2] as going beyond "direct intention".
- The disturbance offence catches disturbance which is significant in that it is likely to be detrimental to the animals of an EPS or significantly affect their local abundance or distribution.
- Sporadic trivial disturbance such as that resulting in short term behavioural reactions is not likely to result in an offence being committed.
- The disturbance offence includes disturbance that could be likely to increase the risk of a negative impact on Favourable Conservation Status.

## *1.1. The two offences- deliberate injury and deliberate disturbance*[vi]

Regulations 41(1) and 39(1) of the HR and the OMR, respectively provide that a person is guilty of an offence if he—

"(a) deliberately captures, injures, or kills any wild animal of a European protected species;

(b) deliberately disturbs wild animals of any such species

(2/1A) For the purposes of paragraph (1)(b), disturbance of animals includes in particular any disturbance which is likely—

(a) to impair their ability—

(i) to survive, to breed or reproduce, or to rear or nurture their young; or

(ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate; or

(b) to affect significantly the local distribution or abundance of the species to which they belong."

## *1.2. Definitions and rationale for interpretation*

### *1.2.1. Deliberate*

The term 'deliberate' has been considered in two European Court of Justice cases (C-103/00 and C-221/04) relating to the operation of the Habitats Directive. The EC guidance on the strict protection of animal species[1] [section II.3.1. paragraph 31] states that the Court *"seems to interpret the term 'deliberate' in the sense of conscious acceptance of consequences*". The term 'deliberate' therefore has to be interpreted as going beyond 'direct intention'. The EC guidance document then draws on the approach taken by the Court, to propose the following

[vi] As previously stated, the wording of this offence in legislation for Scotland and Northern Ireland contains some slight differences to the above. Any operators whose activities may result in impacts on species in territorial waters surrounding Scotland or Northern Ireland should ensure that they are familiar with these differences and that their activities will satisfy any particular requirements for each administration.

definition: "'*Deliberate' actions are to be understood as actions by a person who knows, in light of the relevant legislation that applies to the species involved, and the general information delivered to the public, that his action will most likely lead to an offence against a species, but intends this offence or, if not, consciously accepts the foreseeable results of his action*" [section II.3.1 paragraph 33].

Although there is little domestic case law which assists in defining the term in the UK, regulation 3(3) of the HR (regulation 2(3) of the OMR) provides that, unless the context otherwise requires, expressions used in the HR (and OMR) have the same meaning as in the Habitats Directive.

'Deliberate' action is thus wider than what we usually understand to be 'intentional' action under English and Welsh law (see Appendix I).

#### *1.2.2. Disturbance*

Regulations 41(2) and 39(1A) (of HR and OMR, respectively) provides particular examples of some effects of disturbance that may be detrimental to animals, and which can potentially have an impact on the status of the species. The list is not exhaustive, however, so it is possible that other effects of deliberate disturbance could be considered an offence. Due to the complexities of interactions between activities, species and localised circumstances, it is impractical for this guidance to consider every permutation and state categorically whether an offence is or is not likely to occur (see p.12 for further discussion). It is for marine users, regulators and the courts to assess whether an offence is likely to occur/have occurred. However, by examining the intentions behind the Habitats Directive it is possible to get a better idea of what types of disturbance might be more likely to constitute an offence. This document examines the conservation reasons for the prohibition of disturbance of EPS, and provides guidance on those types of disturbance which are likely to constitute an offence.

The term "disturbance" is not defined in Article 1 or Article 12 of the Habitats Directive or in the HR or OMR. The EC guidance on the strict protection of animal species[1] states that "*[i]t would…seem logical that for disturbance of a protected species to occur a certain negative impact likely to be detrimental must be involved* [section II.3.2 paragraph 38]. The guidance also states that *"In order to assess a disturbance, consideration must be given to its effect on the conservation status of the species at population level and biogeographic level in a Member State. For instance, any disturbing activity that affects the survival chances, the breeding success or the reproductive ability of a protected species or leads to a reduction in the occupied area should be regarded as a "disturbance" in terms of Article 12. On the other hand, sporadic disturbances without any likely negative impact on the species, such as for example scaring away a wolf from entering a sheep enclosure in order to prevent damage, should not be considered as disturbance under Article 12.* [section II.3.2 paragraph 39].

Although not legally binding, the EC guidance[1] makes it clear that, in the Commission's view, sporadic disturbances without any likely negative impact on the species, i.e. *trivial disturbance* should not be considered as disturbance under Article 12.

Following amendments, the HR and the OMR better define the level of disturbance which constitutes an offence. Regulations 41(2) and 39(1A) of the HR and the OMR, respectively make it clear that any disturbance which is likely to have any of the negative effects described in that paragraph – all of which are potentially significant contributors with regard to impact

on the conservation status of the species –will amount to disturbance under regulations 41(1)(b) and 39(1)(b), of the HR and OMR respectively.

The EC guidance[1] states that the strict protection obligations under Article 12 aim to fulfil the objectives of the Habitats Directive, by contributing to the **maintenance or restoration at *favourable conservation status*, of the populations of the species concerned in their natural range**, **while taking into account economic, social and cultural requirements and regional and local characteristics** [section II.2.2. paragraph 17]. In order to assess whether a disturbance could be considered non-trivial in relation to the objectives of the Directive, consideration should be given to the definition of the **favourable conservation status (FCS) of a species** given in Article 1(i) of the Habitats Directive (see Appendix II). There are three parameters that determine when the FCS of a species can be taken as favourable.

1) '*Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable element of its natural habitats'.*

Put simply, this parameter requires that the population(s) of the species is maintained on a long-term basis. Therefore, any action that is likely to increase the risk of long-term **decline of the population(s)** of the species could be regarded as disturbance under the Regulations.

2) '*The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future'*

This parameter requires that the area over which the species may be expected to be found is not shrinking or expected to shrink in the near future. Therefore, any action that is likely to increase the risk of a **reduction of the range** of the species can be regarded as disturbance under the Regulations.

3) '*There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis'.*

The final parameter requires that the habitat on which the species depends (for feeding, breeding, rearing etc) is maintained in sufficient size to maintain the population(s) over a period of years/decades. Any action that is likely to increase the risk of a **reduction of the size of the habitat** of the species can be regarded as disturbance under the Regulations.

It is concluded here therefore that for it to be considered non-trivial, the disturbance to marine EPS would need to be **likely to at least increase the risk of a certain negative impact on the species at FCS**. Any action that would impair the ability of animals to survive, breed or reproduce, or rear or nurture their young, or to migrate could increase the risk of detriment to population viability on a long-term basis. Any action that would cause a significant deviation from a population's natural variability in distribution or abundance could increase the risk of reduction of the natural range or size of the habitat of a species and also the risk of detriment to population viability.

The following section outlines the process for assessing the likelihood that a deliberate disturbance offence will be caused. If marine users consider that any planned activities are likely to cause any of the above impacts, or if they are unsure, they should speak to the relevant competent authority and/or statutory nature conservation body.

**Please note that throughout this document, when 'disturbance' is discussed as an offence it is within the meaning of deliberate non-trivial disturbance as discussed above.**

# 2. Risk assessment approach

**Key Points:**

- This section provides guidance on how to assess and manage the risk of causing injury or disturbance to a marine EPS as a result of activities at sea. This outlines a preventative approach to ensure the strict protection of marine EPS as required by Article 12 of the Habitats Directive.
- The suggested risk assessment approach follows a two-step process: assessing the likelihood of offence, and then whether a licence should be sought. This is illustrated in the flow-diagram below.

This guidance acknowledges that the information available to undertake a risk assessment for the offences in the HR and OMR may be less than ideal in many cases. However, there are recent tools and criteria that provide a framework for risk assessment. In many situations, sufficient information already exists or can be collected to feed into such a framework. Some degree of expert judgement will be necessary, and uncertainty should be addressed through reasonably conservative assumptions. The process of assessing the likelihood of committing an offence should also help to identify gaps in knowledge and foster data collection and research to reduce the uncertainty in future risk assessments. Government and industry initiatives will continue to address those gaps.

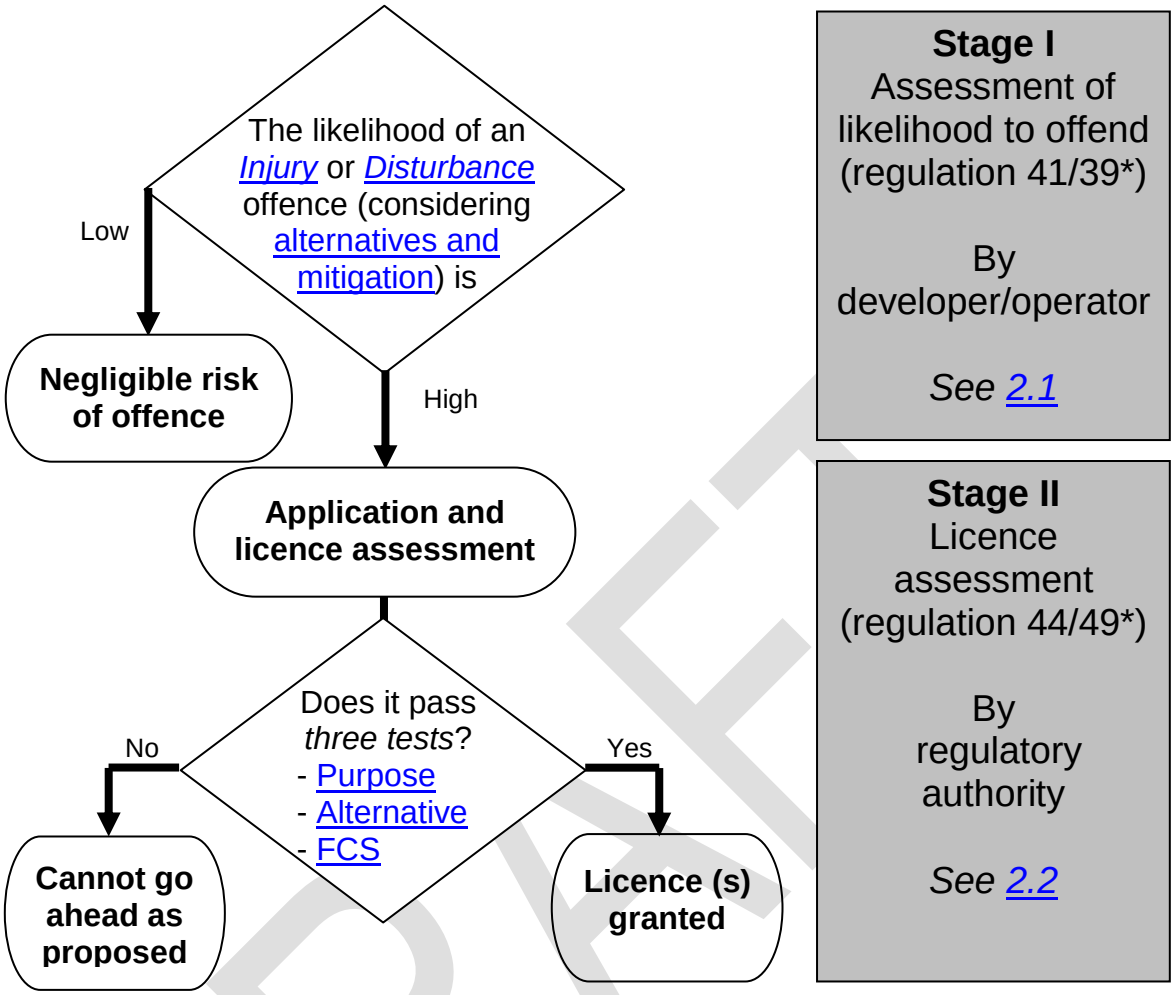
It may be difficult to ascertain whether or not a cause and effect link exists between an activity and impacts on marine EPS that might constitute an offence. This is due to difficulties in:

a) identifying certain injuries;
b) observing and interpreting marine EPS behaviour;
c) relating disturbance to effects on vital rates (e.g. reproductive rate);
d) accounting for the totality of anthropogenic pressures on populations; and
e) distinguishing effects from inherent natural variability.

For example, a displacement of even a large number of animals could be part of a generalised species/population distribution shift that could be caused by factors other than disturbance (e.g. the harbour porpoise distribution shift in the North Sea[3]; and the decline in the bottlenose dolphin utilisation of the Moray Firth SAC concomitant with an expansion of their range along the Scottish east coast[4]). Accordingly, marine users should focus **on the assessment and management of risk by seeking alternative methods or locations for the activity, applying mitigation and following good practice guidelines.**

The flowchart below illustrates the suggested two-stage approach to risk assessment for offences 41(1)(a) and (b) and 39(1)(a) and (b), of the HR and OMR, respectively. The onus is on persons responsible for activities to make sure they take the following steps before they start:

1) assessment of the likelihood of committing an offence (taking into consideration alternatives and mitigation measures) (Stage I); and
2) if an offence is still likely, and only as a **last resort**, decide whether to apply for a licence. The licence assessment (Stage II) process (comprised of three tests) will determine the likely consequences of any activity for which a licence is sought.




* of the HR and OMR, respectively

*Case-by-case vs generic approaches*

A case-by-case approach is needed when assessing the likely impact of an activity on a marine EPS. This is because the specific characteristics of both the *activity* and the *species* and populations potentially affected will be relevant to whether an offence could be committed. Those wishing to carry out certain activities at sea will need to collect information to feed into their environmental assessments. The information they collect could also be used to inform a risk assessment in relation to whether or not a disturbance/injury offence is likely to occur under the legislation addressed in this guidance.

In any given region, there might be scope for collaborative and /or generic risk assessments for multiple/similar developments, operations or marine uses. Such a risk assessment could take into account variations of the characteristics of the activity, and of the local environment, and of the species likely to be in the area. The conclusions of the assessment could then feed back and be adapted to individual operations if appropriate, informing the adoption of mitigation measures and/or the pursuit of alternatives. Developers are encouraged to work together where possible to share information and undertake generic assessments. Such an

approach will likely enhance the quality of, and confidence in, the relevant environmental assessments.

In all cases, advice should be sought from the statutory consultation bodies (including nature conservation agencies) and the offences risk assessment should be clearly identified if it is part of a wider environmental assessment[vii].

*Beyond the prohibitions of injury and disturbance to EPS*

Due to the potential cumulative nature of injury and disturbance effects, in certain areas the management of noise to which EPS are exposed might have to be considered beyond the individual activity licensing framework, for example through a noise management plan. This is because the effects of a single activity may not be sufficient to cause injury or disturbance under the Regulations, but in combination with other activities in the area, the effects on the animals could reach offence levels. A noise management plan might be useful in areas where there are multiple noise producing activities and where the same animals could be chronically exposed to noise, or where high EPS densities are characteristic of the area. This approach is in line with the EC guidance on the strict protection of animal species[1], which states in section II.2.3., paragraph 21, that "for some species and in some situations, the adoption and implementation of purely prohibitive measures may not be sufficient, and may not guarantee effective implementation of Article 12."

**Summary**

- The likelihood of an activity resulting in injury or disturbance to a marine EPS will very much depend on the characteristics of the activity, of the environment and the species concerned, hence the need for a case-by-case approach when assessing the risk of it occurring. However, there is scope for broader collaborative impact assessments to be carried out and its conclusions to feed back to individual operations.

- In some areas where the combined effects of multiple activities could lead to disturbance or injury, it may be appropriate to consider implementing wider noise management measures, e.g. a noise management plan.

[vii] It is beyond the scope of this guidance to detail legislative requirements for different environmental assessment processes. It is for marine users to ensure that they are aware of and comply with their legal obligations in relation to those assessments. For instance, marine users carrying out certain consented activities may need to provide an assessment of the environmental impact of activities under legislation implementing the Environmental Impact Assessment (EIA) Directive (85/337/EEC). In collecting information for the different types of environmental assessment, marine users should assess the risks of committing an injury or disturbance offence as part of the process. Where Special Areas of Conservation (SACs) have been designated for those EPS also listed on Annex II of the Habitats Directive, in addition to undertaking a risk assessment in relation to the disturbance/injury offence, if the plan or project is likely to have a significant effect on the SAC then developers will also need to consider obtaining the information necessary to allow an assessment by the competent authority (as specified by the HR and OMR) of the implications of that plan or project for the site in view of that site's conservation objectives. This is known as an Appropriate Assessment. The bottlenose dolphin is currently the only species in the UK that is an EPS and also a qualifying feature of SACs.

## *2.1. Stage I - Assessing the likelihood of an offence – guidance for environmental assessment*

**Statutory status: This section contains guidance on the deliberate injury and disturbance offences. Insofar as it provides guidance on the disturbance offence in regulations 41(1)(b) and 39(1)(b) of the HR and OMR, respectively, a court must take it into account in proceedings for such an offence, as stated in regulation 41(10) of the HR and 39(8) of the OMR. Insofar as it provides guidance on the injury offence in regulations 41(1)(b) and 39(1)(b) of the HR and OMR, respectively, it may or may not be taken into consideration by courts.**

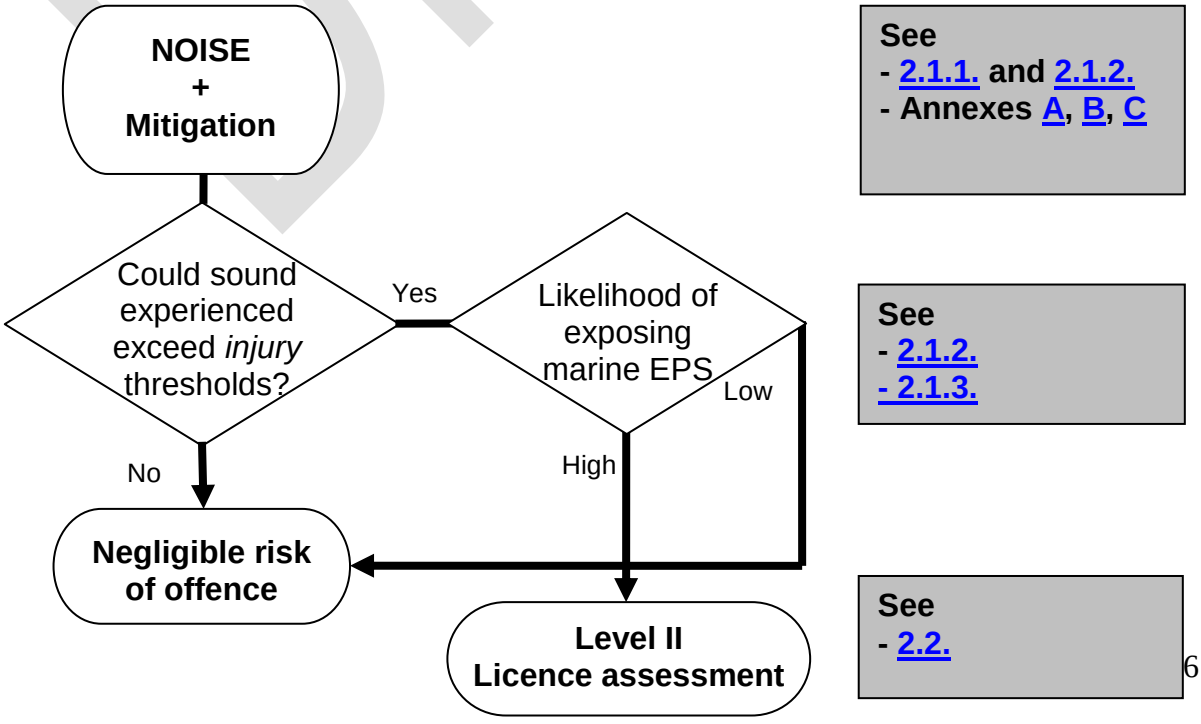
Any risk assessment should start by considering whether any injury and/or disturbance offences are likely, based primarily on the nature, the duration and extent of the activity(ies). While a short-term operation affecting a small area could result in an injury offence, it is more likely that a disturbance offence would occur as a result of a long-term operation or combination of operations.

*Deliberate injury – regulation 41(1)(a) and 39(1)(a) of the HR and OMR, respectively*

The following two main factors have the potential to cause an injury/kill, resulting in an offence:
a) physical contact, including collision; and
b) anthropogenic sound (noise).

Both factors should be considered in a risk assessment, if appropriate. In this guidance we focus on anthropogenic sound as this is the most pervasive factor with the potential to cause an offence and its potential effects are the more challenging to assess and mitigate. Loud sounds can cause direct auditory tissue damage or shifts in hearing thresholds. An injury offence assessment should be carried out for activities with the potential to injure or kill a marine EPS in areas where it is likely that animals would be exposed. These activities can be long or short-lived in any given area (less than 24 hours), and include explosive use, seismic surveys, navigation by high speed vessels, and pile-driving. However, if mitigation measures are appropriate and effectively implemented, the risk could be reduced to negligible levels.

The following flowchart illustrates the suggested approach to risk assessment for offence 41(1)(a) and 39(1)(a), 'deliberate injury', of the HR and OMR, respectively.

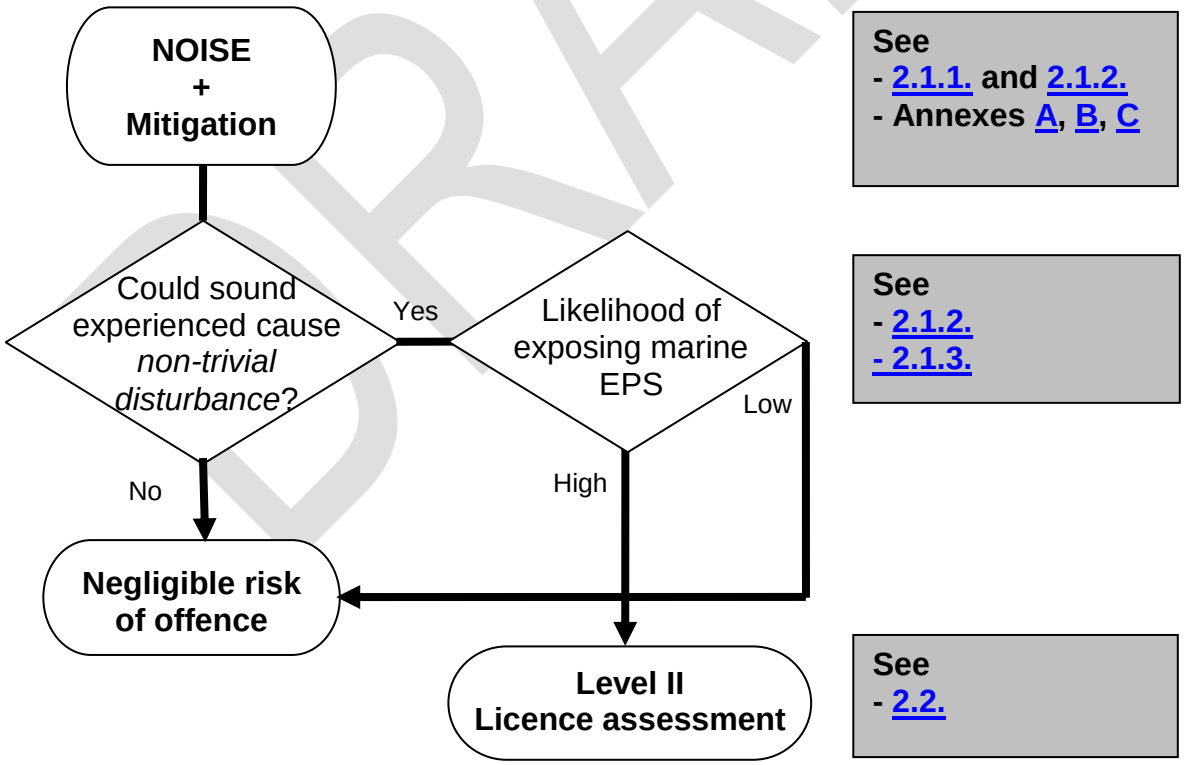


*Deliberate disturbance – regulations 41(1)(b) and 39(1)(b) of the HR and OMR, respectively*

Anthropogenic sound is the factor with the most potential to result in a disturbance offence in relation to marine EPS commonly found in UK waters. A disturbance offence assessment should be carried out for certain **long-lasting** or **recurring** activities, which have the potential to impair the ability of a marine EPS to survive, breed or reproduce, or rear or nurture their young, or to migrate or significantly affect a population's local distribution and abundance.

For most cetacean populations in UK waters, disturbance, in terms of the HR or OMR, is unlikely to result from single, short-term operations, e.g. a seismic vessel operating in an area for 4-6 weeks, or the driving of a dozen small diameter piles. Such activities would most likely result in temporary sporadic disturbance, which on its own would not be likely to impair the ability of an animal to survive, reproduce, etc, nor result in significant effects on the local abundance or distribution. Non-trivial disturbance, which would constitute an offence under the Regulations, would most likely result from more prevalent activities in an area, chronically exposing the same animals to disturbance or displacing animals from large areas for long periods of time. Examples of activities for which the risk of a disturbance offence should be assessed include commercial whale-watching and pile driving in one area for a long period of time.

The following flowchart illustrates the suggested approach to risk assessment for offence 41(1)(b) and 39(1)(b), 'deliberate disturbance', of the HR and OMR, respectively.



### *2.1.1. Alternatives and/or mitigation*

Lower-risk alternatives to the proposed activity need to be considered at this stage. These could include different development scales or designs and different methods, placing the activity in a different area, and spatio-temporal restrictions. Activities should be timed and located, as much as possible, to avoid periods and areas where animals of a marine EPS could be present, or at least present in high densities. However, in many cases this is likely to be difficult to achieve given the unpredictable nature of cetacean distribution and abundance. Nevertheless, in some situations, suitably locating activities in time and space could be sufficient to reduce the likelihood of offence. Where alternatives are sought, consideration must be given to the impact on other protected species/habitats. A consideration of possible alternatives should form part of the environmental impact assessment. It should include details on the characteristics of alternative methods and equipment, highlighting their availability and feasibility. This is particularly important if an EPS/wildlife licence is to be applied for, because as part of the licensing process an objective demonstration of why lower risk alternatives have been discounted will have to be made (see Section 2.2.2).

Mitigation measures should be put in place whenever there is concern that an activity is likely to have a significant impact. The measures should recognise the limitations and uncertainty in the assessment of risk and use the precautionary principle in a manner proportionate to the risk of injury or disturbance. For example, more caution would be applied if the effects could be more detrimental to the animals, or if it was likely that animals would be exposed to the noise for long periods.

The detailed description and justification for the mitigation measures adopted should form part of risk assessments. The Annexes (A, B, C) to this guidance provide good practice guidelines for specific activities. It is considered that they currently represent best practice and having them in place should reduce the risk of an injury offence. If, despite following guidelines, an offence does unexpectedly occur and is proven, then the preventative and precautionary actions that were taken would likely be relevant to the question of whether the action was ‘deliberate’. The efficacy of some of the mitigation measures set out in the guidelines has not been fully tested, but these are based on reasonably conservative assumptions and efforts are underway to assess how effective they are in reducing the risk.

Mitigation measures are more relevant to the prevention of injury or death than to disturbance. This is because animals can become exposed to sounds that could cause behavioural reactions at distances from a noise source beyond those that are mitigated for in the existing best practice guidelines. However, for some activities in some situations, mitigation measures may help reducing the risk of disturbance. It is up to the developer or entity responsible for the activity to assess whether disturbance is likely to occur and to then consider other possible and adequate mitigation measures or alternatives.

**Summary**

- Pursuing alternative methods, locations and/or times for carrying out proposed activities might in some cases be sufficient to reduce the risk of causing offence.
- Mitigation measures such as those presented in Annexes A, B and C of this document are likely to reduce the risk of an injury offence to negligible levels but the risk of disturbance might have to be mitigated in some other way or as a last resort covered by an EPS licence.
- Alternatives and mitigation should be considered when undertaking the risk assessment.

#### *2.1.2. Assessing the likelihood that the sound experienced by the animals exceeds injury and/or disturbance thresholds*

A noise exposure assessment should be carried out in order to ascertain whether injury and/or disturbance thresholds are likely to be exceeded. The following factors should be considered:

a) **Duration** and **frequency** of the **activity**;
b) **Intensity** and **frequency** of **sound** and **extent of the area** where injury/disturbance thresholds could be exceeded, taking into consideration **species-specific** sensitivities;
c) The interaction with other concurrent, preceding or subsequent activities in the area (**in-combination** effects);
d) Southall *et al.* (2007)[5] thresholds for injury and behavioural responses, and other relevant published studies.
e) Whether the local abundance or distribution could be significantly affected

*a) Duration and frequency of the activity*

The likelihood that an offence is committed can depend on the temporal characteristics of the activity. For example, for most species it is unlikely that any single operation producing loud noises for less than 24 hours will result in a disturbance offence. However, an injury offence could result from such a short-term operation if animals were present in the vicinity at the time and exposed to sound levels above a certain threshold. The duration of the anthropogenic sound should therefore be one of the first parameters to consider in the assessment. This will determine whether there is potential for an injury offence and/or disturbance. When the exact schedule, duration or frequency of the activity are not known, different scenarios should be considered in the EIA and the risk associated with each scenario should be assessed.

The EC guidance on the strict protection of animal species[1] states that '*the intensity, duration and frequency of repetition of disturbances are important parameters when assessing the possible impact of disturbance on a species*' [section II.3.2.a), paragraph 37]. Thus a **single act may fall below the threshold of the offence, but a repetition of the same act for long periods of time may result in the threshold being reached**. For example, an operation that lasts for less than 24h but is recurrent on subsequent days for several weeks to months could have a higher potential for a disturbance offence than an operation that emits loud noises continuously for 24h.

*b) Intensity and frequency of sound, and the size of the area affected*

In order to assess, and mitigate against, the full spectrum of potential effects, it is essential to know the **distances from the sound source** up to which species with differing auditory sensitivities could be affected (according to injury and behavioural response thresholds). Ranges of impact on species will depend on:

i) the *sound source characteristics* (source level, frequency range),
ii) the *sound propagation* characteristics of the local environment (depth, substrate, water physical-chemical properties),
iii) the species in the area affected and their *auditory sensitivity* (i.e. the frequency range they can sense), and
iv) what *mitigation measures* can be adopted.

Cetacean species can be classified into three functional hearing groups based on their *auditory sensitivity*: low frequency (7 Hz to 22 kHz), medium frequency (150 Hz to 160 kHz) and high frequency (200 Hz to 180 kHz). The level at which the sound is received by the animal will depend on its frequency with relation to the species frequency sensitivity. For example, some bats generate very loud sounds, but because these are high-pitched (high-frequency) they fall above the range of human hearing and therefore cannot be heard by humans. Similarly, certain sounds resulting from activities in the marine environment will not be heard by all cetacean species, or at least not heard with the same loudness. To take this into consideration when estimating the level of the received sound to the animal, Southall *et al.* (2007) developed different weighting functions for each of the three functional hearing groups. These place lower importance on frequencies that are near the lower and upper ends of the group's estimated hearing range.

*c) In-combination effects*

A single operation could be one of many sources of noise (anthropogenic and natural) in an area. A contextual approach in assessing noise budgets and background noise in the area will allow for a more accurate assessment of potential noise exposure and more adequate mitigation.

*d) Southall et al. (2007) thresholds and comparative studies*

On the basis of observed cetacean physiological and behavioural responses to anthropogenic sound, Southall *et al.* (2007) proposed **precautionary noise exposure criteria** for injury and behavioural responses. These criteria are currently the best available. Although they are still under development and have not yet been tested in the context of noise management, their use is recommended since they provide framework criteria which will be further developed as new evidence arises.

**Injury**

To prevent **injury,** Southall *et al.* (2007) proposed quantitative thresholds for levels of sound received by the animal (see Table 1), corresponding to the estimated onset of a permanent shift in hearing thresholds, or PTS. For example, for single and multiple pulsed sound types such as a single pile strike and sequential pile strikes, respectively, the threshold should correspond to a received Sound Exposure Level (SEL) of 198dB re: 1$\mu Pa^2$-s weighted by functional group or a received Sound Pressure Level (SPL) of 230dB re: 1 μPa (peak) (flat) whichever is exceeded first. For non-pulsed sounds such as a vessel passing, the same SPL but higher SEL were proposed, since cetacean hearing seems to be more vulnerable to pulsed than to non-pulsed sounds.

For certain beaked whale species exposed to non-pulsed sound, Southall *et al.* (2007) noted that special injury criteria, with thresholds lower than for other species, are likely to be needed, since the several mass strandings observed seem associated with sound levels lower than those that would normally cause auditory injury to other species. A recent study suggested that harbour porpoises might also have lower thresholds for injury[6], with the onset of a temporary shift in hearing thresholds (Temporary Threshold Shift, TTS-onset) having been observed at a received sound pressure of 200 dB peak-peak re 1 μPa and sound exposure level of 164 dB re 1 $\mu Pa^2$-s. For this species, an estimation of PTS based on this study could therefore be used as a more precautionary threshold to that in Table 1.

Table 1. Southall *et al.* (2007) proposed injury criteria for individual cetaceans exposed to "discrete" noise events (either single or multiple exposures within a 24-h period). It should be assumed therefore that sound exposure above these levels is likely to cause injury.

| **Cetacean functional group** | **Sound Type** | | |
|---|---|---|---|
| | Single pulses | Multiple pulses | Nonpulses |
| *Low-frequency cetaceans* | | | |
| Sound pressure level | 230 dB re: 1 μPa (peak) (flat) | 230 dB re: 1 μPa (peak) (flat) | 230 dB re: 1 μPa (peak) (flat) |
| Sound exposure level | 198 dB re: 1 $\mu Pa^2$-s (Mlf) | 198 dB re: 1 $\mu Pa^2$-s (Mlf) | 215 dB re: 1 $\mu Pa^2$-s (Mlf) |
| *Mid-frequency cetaceans* | | | |
| Sound pressure level | 230 dB re: 1 μPa (peak) (flat) | 230 dB re: 1 μPa (peak) (flat) | 230 dB re: 1 μPa (peak) (flat) |
| Sound exposure level | 198 dB re: 1 $\mu Pa^2$-s (Mlf) | 198 dB re: 1 $\mu Pa^2$-s (Mlf) | 215 dB re: 1 $\mu Pa^2$-s (Mlf) |
| *High-frequency cetaceans* | | | |
| Sound pressure level | 230 dB re: 1 μPa (peak) (flat) | 230 dB re: 1 μPa (peak) (flat) | 230 dB re: 1 μPa (peak) (flat) |
| Sound exposure level | 198 dB re: 1 $\mu Pa^2$-s (Mlf) | 198 dB re: 1 $\mu Pa^2$-s (Mlf) | 215 dB re: 1 $\mu Pa^2$-s (Mlf) |



## Disturbance

To prevent severe **behavioural responses** to noise, the sound level thresholds are likely to be much lower than those in Table 1, but several authors have pointed out that the level of sound received by the animal does not seem to be the sole important aspect in determining the response and its significance. Southall *et al*. (2007) demonstrated the large variability in received sound levels (RLs) associated with behavioural responses, reflecting the fact that contextual variables might be at least as important as exposure level in predicting response type and magnitude. The type and intensity of an animal's response seems to vary depending upon the ratio between the sound in question and ambient noise, the rate of change of the sound; and also the behavioural context and motivations at the time, the previous experience of exposed individuals and how the animal interprets the sound (whether as a predator or simply as an annoying stimulus). For this reason, Southall *et al.* (2007) recommended that **the only currently feasible way to assess whether a specific sound could cause disturbance was to compare the circumstances of the situation of concern with empirical studies that have carefully controlled variables.**

Southall *et al.* (2007) also highlighted the fact that the interpretation of behavioural responses is very limited by uncertainty as to what constitutes biologically significant disturbance (i.e. disturbance that could affect feeding or breeding, for example). Therefore, they did not suggest specific numerical criteria for the onset of what could be considered biologically significant disturbance but graded the severity of context-specific *behavioural responses* to noise exposure, as follows: relatively minor and/or brief, score 0-3; with higher potential to affect feeding, reproduction, or survival, score 4-6; and considered likely to affect these life functions, score 7-9.

Southall *et al.* (2007) list and describe relevant studies published before 2007. The authors noted that for *low-frequency cetaceans* the onset of significant behavioural responses was at RLs around 140 to 160 dB re: 1 µPa or higher, for multi-pulsed sounds, and an increasing probability of avoidance and other significant behavioural effects in the 120 to 160 dB re: 1 µPa range for non-pulsed sounds.

The combined data for *mid-frequency cetaceans* exposed to multi-pulsed sounds did not indicate a clear tendency for increasing probability and severity of response with increasing RL. Reactions were observed occurring for RLs as low as 80 dB re: 1 µPa while, in other cases, RLs in the 120 to 180 dB re: 1 µPa range failed to elicit observable reactions. The same was observed for non-pulsed sounds, with some studies showing responses with high behavioural response severity scores to exposures from 90 to 120 dB re: 1 µPa, while others failed to exhibit such responses for exposure RLs from 120 to 150 dB re: 1 µPa.

For *high frequency cetaceans*, Southall *et al.* (2007) highlighted the need for more empirical research into how multi-pulsed sounds are perceived by this group of cetaceans. For non-pulsed sounds, harbour porpoises, for example, seem sensitive to very low exposure RLs (~90 to 120 dB re: 1 µPa) and all recorded exposures exceeding 140 dB re: 1 µPa "induced profound and sustained avoidance behaviour of these animals in the wild".

Despite a lack of studies with carefully controlled variables of mid- and high-frequency cetaceans exposed to multi-pulsed sounds, there are studies which provide the basis for more qualitative assessments. For example, harbour porpoises have been observed to avoid construction areas during pile driving activities at least up to a distance of 15km[7-9]. These studies should be used in the absence of empirical studies with carefully controlled variables, but the uncertainty and assumptions made should be made clear.

The authors noted that it is the repeated or sustained disruption of behaviours such as feeding or communication that is likely to have a significant effect on vital rates (e.g. reproductive capacity, life expectancy) and not just brief responses to the factor of disturbance. A reaction lasting less than 24h and not recurring on subsequent days was not regarded as particularly severe by Southall *et al.* (2007) unless it directly affects survival or reproduction**.** Behavioural changes such as moving away from an area for short period of time, reduced surfacing time, masking of communication signals or echolocation clicks, vocalisation changes and separation of mothers and calves for short periods, do not therefore necessarily imply that this will result in detrimental effects on the animals involved.

In this guidance, disturbance as described in regulations 41(2)(a) and 39(1A)(a) of the HR and OMR is interpreted as **sustained or chronic** disruption of behaviour scoring 5 or more in the Southall *et al.* (2007) behavioural response severity scale. The risk assessment should therefore consider the likelihood of the activity resulting in responses lasting more than 24h or recurring on subsequent days for long periods of time. The more severe the response on the Southall *et al.* (2007) scale, the less time the animals will tolerate it before there could be significant negative effects on their life functions, which would constitute disturbance under the Regulations. Conversely, less severe reactions could constitute disturbance under the Regulations if there is chronic disruption of behaviour. This could happen for certain activities that expose the same animals to noise for many weeks, months, or years.

*e) Significant effects on the 'local distribution or abundance' of the species*

This is relevant to the question of whether a s41(1)(b) or s39(1)(b) disturbance offence has been committed, having regard to the factors set out in regulations 41(2)(b) and 39(1A)(b) of the HR and OMR, respectively. This element of an offence will be of concern mainly in areas considered to be essential habitat or for activities affecting an area for long periods of time. The significance of changes in local abundance or distribution will depend on its temporal and spatial scale and the relative quality of the habitat to which animals may be re-distributed. The following aspects should be taken into consideration when assessing whether the local distribution or abundance of a species is likely to be significantly affected by the activity of concern:

i) evidence of species **displacement** as a result of disturbance (see Southall *et al.* (2007) and other references);
ii) whether the displacement is likely to significantly **deviate from natural (spatio-temporal) variability** in distribution and abundance;
iii) the context of the displacement in relation to **other potential displacements** caused by disturbance in the wider area.

*i) Displacement*

In contrast with terrestrial mammals, where there might not be adjacent alternative areas for the animals to move to (due to lack of connectivity between habitats), there will usually be adjacent areas for cetaceans to move to that are within the natural range of their populations, and hence compensate for the loss of, or displacement from, a particular area of habitat[10; 13]. However, it cannot be assumed that displaced animals will fare as well in some other part of their range[14], since adjacent areas might be already populated, potentially resulting in increased competition, or might be of lower habitat quality. For example, large baleen whales generally have a 1-year cycle during which they carry out migrations to high latitudes to feed in the summer and then fast for the rest of the year at lower latitudes. Disturbance that displaced a baleen whale from its high latitude feeding grounds for a significant proportion of the feeding season could therefore have serious consequences for its survival and breeding success.

There is evidence that loud sounds caused by some activities can result in cetaceans being displaced from particular areas[7; 10-12]. However, the consequences to the animals of displacement are likely to vary, dependent on the duration of the displacement and whether it is temporary or permanent.

ii) *Deviation from natural variability in distribution and abundance*

Cetacean populations occurring in UK waters are generally wide-ranging, and their distribution and abundance will vary considerably in time and space and be influenced by both natural and anthropogenic factors. For a significant effect on the local distribution or abundance of a species to occur, disturbance would need to produce more than a short transient effect and result in a significant deviation from the natural variability (in distribution or abundance) for that species or population. This would occur, for example, if a number of animals became displaced from an area used frequently, for a period longer than they would normally be absent. If the animals only use an area occasionally, then even one month of displacement might not be important. Conversely, if animals are persistently found in a particular season in an area, then even just a week of displacement could be considered disturbance. The significance of the duration of the potential displacement would therefore have to be assessed on a case by case basis, depending on the spatio-temporal patterns of the species occurrence in the area affected.

*iii)* *Other potential displacements*

The risk of in-combination effects of displacement as a result of disturbance should also be considered. For example, harbour porpoises may avoid areas where pile driving is occurring. The use of pile driving in a series of contemporary construction works within the natural range of a population could exclude the species from areas where they would normally occur, for significantly longer periods of time than what would be expected naturally. Assessing the potential effects of individual construction works would not reveal the total extent of the potential displacement.

### *2.1.3. Assessing the likelihood of exposure*

The likelihood of animals of an EPS occurring in the area of the activity has to be established. In addition, the numbers of animals of a species that could be potentially affected should be estimated. For this to be carried out, it is essential to consider the extent of the area around the activity that could be affected by sounds with the potential to injure or disturb and multiply it by the species density (this should also include calculations relative to confidence intervals or some other measure of uncertainty). Information on species densities can be obtained from past surveys of the area where the activity is proposed or of a comparable area.

Estimates of broad regional densities for some parts of UK waters can be obtained from the SCANS II (Small Cetaceans in the European Atlantic and North Sea)[3] and CODA (Cetacean Offshore Distribution and Abundance ) reports, see Figure 1 and Table 2, and Figure 2 and Table 3 and 4) and should be used if no other, finer-scale density information is available. However, it is important to bear in mind that the SCANS II and CODA surveys are only synoptic since they were carried out in a single month of one year (2005 and 2007, respectively) and they did not cover the entire range of most populations. The UK is evaluating current monitoring of cetacean populations and considering the future surveillance strategy. As a consequence of a UK cetacean surveillance strategy, finer-scale information on species densities should start to become available and should then be used in preference to existing regional data.

In cases where there is a risk of disturbance and there is insufficient information on the cetacean species in the area of the activity, dedicated surveys may be recommended over a number of months, seasons or years before the start of the activity (dependent on the planned

timing, duration and frequency of the activity), to aid in the risk assessment and mitigation process. Advice on the need for these surveys should be sought from the nature conservation agencies, which may also advise on methods and overall strategy of data collection.

The risk of exposing an animal of an EPS to noise that could potentially cause a permanent shift in auditory thresholds to that animal (hence constituting an injury offence) is likely to be higher in areas where cetaceans occur frequently and/or in high densities. The risk of significant displacement or chronic exposure of EPS to noise, which could constitute disturbance under the Regulations, is likely to be higher in regions where there are semi-resident populations or where animals occur frequently.

Whenever possible, activities should be planned to avoid areas and times of the year when animals could be present, or at least present in high densities. However, in UK waters, marine EPS do not form discrete, predictable groups, unlike most terrestrial EPS where a considerable proportion of a population or subpopulation gathers in one place at a certain period of the year to breed, for example a bat maternity colony. Cetacean populations are usually fairly dispersed throughout the year, and only certain species/populations seem to form large predictable breeding or feeding aggregations (e.g. Eastern Pacific grey whales breeding off Baja California), but this is not known to occur in the UK. Turtles and sturgeon will form such groups in their breeding areas, but there are no breeding areas in UK waters.

Populations of marine EPS in UK waters more commonly occur dispersed and the animals' schooling behaviour and location at any one time are difficult to predict. Even with pre-development surveys, one might still not be certain of how many animals would be in the area during the operations. For most species, the presence and number of animals using particular areas may vary considerably between seasons and years, limiting the value of seasonal considerations. Evidence of a seasonal pattern in occurrence should be looked at on a case-by-case basis and considered when assessing the likelihood of exposing animals to injury or disturbance. Whenever possible, relevant seasonal density estimates should be used. However, in areas where a species is known to occur but information on seasonality is lacking, or where long-term records do not support the existence of consistent patterns of seasonality, it should be assumed that animals could be present in the area at any time of the year. This is likely to be the most common situation.

**Summary:**

- Certain activities that produce loud sounds in areas where animals of an EPS could be present have the potential to result in an injury offence, unless appropriate mitigation measures are implemented to prevent the exposure of animals to sound levels capable of causing injury.

- This guidance proposes that a permanent shift in the hearing thresholds (PTS) of an EPS would constitute an injury offence.

- The Southall *et al.* (2007) precautionary criteria for injury propose quantitative sound level and exposure thresholds over which PTS could occur.

- If it is likely that an EPS could become exposed to sound at or above the levels proposed by the Southall *et al.* (2007) then there is a risk that an injury offence could occur.

- The risk of an injury offence will be higher in areas where EPS occur frequently and/or in high densities.

- The risk of an injury offence will be negligible in areas where EPS are unlikely to occur.

- It is difficult to come up with quantitative sound level criteria for the onset of disturbance since the level of sound received by the animal does not seem to be the sole important aspect in determining the response and its significance.

- A disturbance offence is more likely where an activity causes persistent noise in an area for long periods of time.

- A disturbance offence is more likely to occur when there is a risk of:
    a. animals incurring sustained or chronic disruption of behaviour scoring 5 or more in the Southall *et al.* (2007) 'behavioural response severity scale'; or
    b. of animals being displaced from the area, with redistribution significantly different from natural variation.

- The risk of a disturbance offence will exist if there is sustained noise in an area and/or chronic noise exposure, as a result of an activity.

- The risk of a disturbance offence is likely to be higher in regions where there are semi-resident populations or where animals of a species occur frequently and in high densities.

- The risk of a disturbance offence will be negligible in areas where EPS are unlikely to occur, occur only occasionally, in small numbers and where individuals are unlikely to remain in the same area for long periods of time.

## *2.2. Stage II - The licence assessment process*

**This section contains guidance to the developer, regulator and nature conservation agencies on the licensing process. There is no requirement for courts to take it into consideration.**

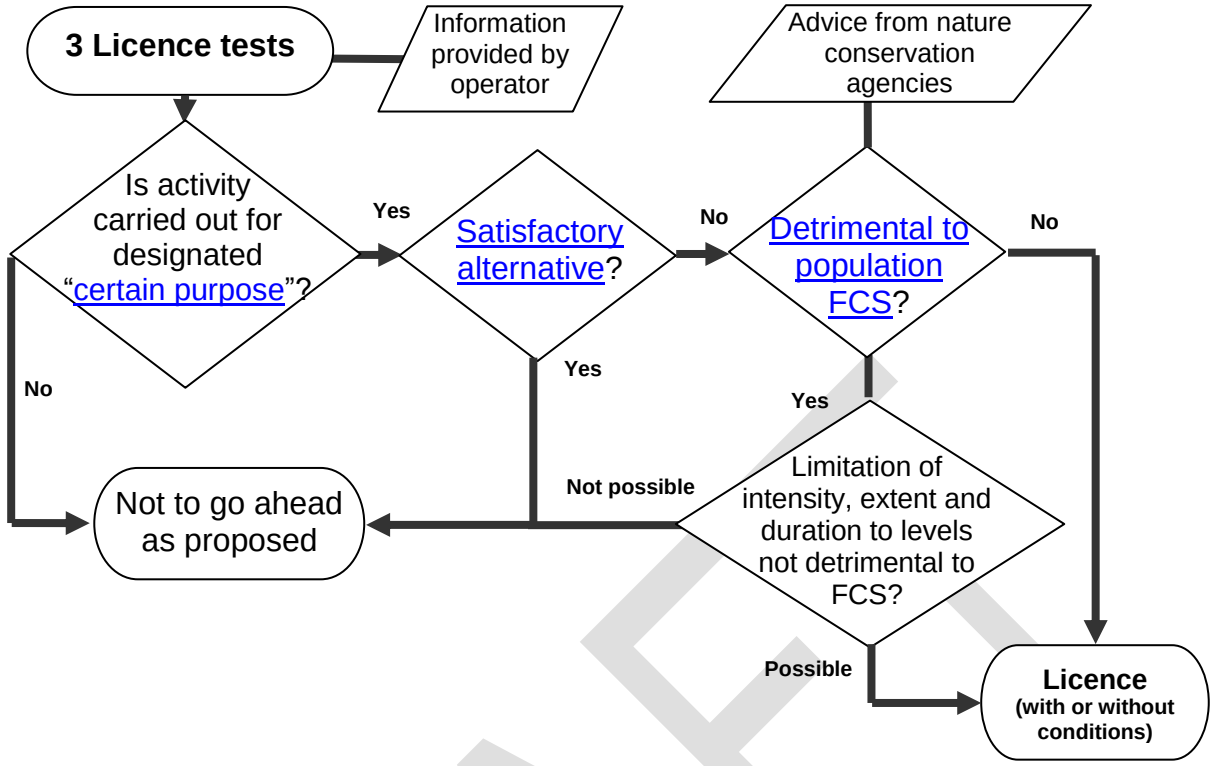
If there is a risk of injury or disturbance of EPS that cannot be removed or sufficiently reduced by using alternatives and/or mitigation measures, then the activity may still be able to go ahead under licence, but this should be a **last resort**. It is expected that many activities at sea will not require a licence to exempt them from regulations 41(1)(a) and (b) and 39(1)(a) and (b) of the HR and OMR, respectively, since their potential for injury and/or disturbance can be effectively mitigated or because the characteristics of the disturbance will fall below the threshold of an offence.

Any licence application (under regulation 53(1) of the HR and 49(6) of the OMR) will necessitate a detailed assessment of whether the licence should be granted. The licence assessment will be comprised of three tests to ascertain: 1) whether the activity fits one of the purposes specified in the Regulations; 2) whether there are no satisfactory alternatives to the activity proposed (that would not incur the risk of offence); and 3) that the licensing of the activity will not result in a negative impact on the species'/population's Favourable Conservation Status. The licence assessment will be carried out by the appropriate authority with the information provided by the developer and advice from nature conservation agencies. Under regulation 53 of the HR the appropriate authorities for England and Wales are the Secretary of State and the Welsh Ministers[viii] respectively, while for the UK offshore marine area, under regulations 49(6) of the OMR it is the Secretary of State that has the function of granting licences[ix]. The following flowchart illustrates the process.



[viii] or NE and CCW for licences for the purpose of scientific and educational research.

[ix] As previously stated, slight differences in legislation applying in Scotland and Northern Ireland may mean additional licences are required before carrying out certain activities. Operators whose activities could impact on species in waters surrounding Scotland or Northern Ireland should ensure they have satisfied any specific requirements applying in those administrations, including those relating to licence applications.




This detailed assessment is comprised of three tests:

#### 2.2.1. *Certain purposes: regulations 53(2) and 49(6) of the HR and OMR, respectively*

Only activities carried out for certain 'purposes' can be licensed, so that regulations 41 and 39 (providing for offences under the HR and OMR, respectively) does not apply. These purposes include "imperative reasons of over-riding public interest including those of a social or economic nature and beneficial consequences for the environment", and "scientific and educational purposes". Guidance on what could constitute 'imperative reasons of over-riding public interest' can be found in: Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC.

#### 2.2.2. *Satisfactory alternative: regulations 53(9)(a) and 49(7)(a) of the HR and OMR, respectively*

Licences can only be granted if the authority considering the licence application is satisfied that there is no satisfactory alternative. The authority considering the licence will have to be satisfied, based on best available information, that alternatives were sought that would not impact on EPS and that none were found or they were not satisfactory.

While this test is part of the licence assessment (Stage II), the authority will expect the developer to provide the information required to support this assessment as part of the EIA. The "alternatives" to minimise the risk of injury and disturbance should therefore be considered when assessing whether the offence is likely (Stage I) (see section 2.1.1.). If no satisfactory alternative is found then an objective demonstration of why alternatives have been discounted will form part of the licence assessment stage.

The EC guidance on the strict protection of animal species[1] [section III.2.2. paragraph 37] states that "an analysis of whether there is "no other satisfactory alternative" can be considered as having three parts: What is the problem or specific situation that needs to be addressed? Are there any other solutions? If so, will these resolve the problem or specific situation for which the derogation (licence) is sought?"

#### *2.2.3. The FCS test: regulations 53(9)(b) and 49(7)(b) of the HR and OMR, respectively*

Licences can only be granted where the authorised activity will not be detrimental to the maintenance of the populations of the species concerned at a Favourable Conservation Status (FCS) in their natural range (see Appendix II for a definition of FCS and a summary of the conservation status assessments for cetaceans in the UK).

No scientific studies have conclusively demonstrated a link between exposure to sound and detrimental effects on a marine mammal population[16]. The consequences of disturbance at the population level require an understanding of the causal mechanisms between the several stages of the disturbance effect, and, in most cases, this is not well understood[16]. The **Population Consequences of Acoustic Disturbance** (**PCAD**)[16] framework provides conceptual guidance for such an assessment. The first stage in this framework considers the links between the activity of concern and its characteristics to short-term changes in, for example, diving behaviour, vocalisation patterns, etc, for which there is a considerable amount of evidence[17-20]. The second stage relates to the effects of those short-term changes on life functions such as feeding, breeding, and migrating[21;22-25]. The third stage relates to how the more immediate effects on those life functions can actually impact the individuals' vital rates (e.g. reproductive rate, life expectancy) over the long-term. This is largely unknown, but it is likely that it is the sustained changes in behaviour associated with life functions that will contribute to changes in vital rates. The fourth stage relates changes in the vital rates of individuals to population effects and this can be modelled through population biology models. The risk assessment guidance in section 2.1.2. (above) fits within the first two stages of the PCAD framework and to the behavioural response severity scale proposed by Southall *et al.* 2007; the threshold for a disturbance offence will fall between stage two and three. The third and fourth stages relate to the FCS test.

The best available information should be used in the context of the PCAD framework for determining whether the activity will be 'detrimental to the maintenance of the populations of the species concerned at FCS in their natural range'. It is likely that the fraction of the population that could be injured/killed/disturbed by the proposed activity will be relevant to the assessment of whether the activity could be detrimental to the maintenance of the population at FCS, and whether the activity should or should not be licensed. Generally, **the larger the fraction of the population that is likely to be affected, the higher the importance of the FCS test.**

In any population with a positive rate of growth, or a population remaining stable at what is assumed to be the environmental carrying capacity, a certain number of animals can potentially be removed as a consequence of anthropogenic activities (e.g. through killing, injury or permanent loss of reproductive ability), in addition to natural mortality, without causing the population to decrease in numbers, or preventing recovery, if the population is depleted. Beyond a certain threshold however, there could be a detrimental effect on

the population. If this was a possibility then the activity could not be licensed and could not go ahead as proposed. Detrimental effects to a population as a result of disturbance to the animals in a population cannot therefore be discounted without undergoing a detailed assessment. See Appendix IV for a discussion on how to assess whether the numbers potentially affected could be of concern for a population's FCS.

In order to estimate the numbers of animals of a species that could be potentially affected, it is essential to consider the areas affected by sounds that could lead to injury or disturbance and multiply it by the species density (this should also include calculations relative to confidence intervals or some other measure of uncertainty). This information should be provided by the developer as part of the environmental assessment process (see Section 2.1.3). to enable the assessment involved in the FCS test to be carried out by the relevant or competent authority. Some degree of expert judgement will have to be employed, with uncertainty addressed through reasonable conservative assumptions. Other natural and anthropogenic pressures on population conservation status will also need to be considered at this stage. A knowledge of other 'licensed disturbances/injuries' that are relevant to the populations is also essential at this stage and should be used by the regulators to inform licensing decisions. In order to assess the exposure risk of populations and manage activities accordingly, it is important to have some idea of the fraction of a population that may be exposed to activities that could result in disturbance or injury as defined in the Regulations in any given period.

# 3. The Activities

**This section contains guidance on the deliberate injury and disturbance offences. Insofar as it provides guidance on the disturbance offence in regulations 41(1)(b) and 39(1)(b) of the HR and OMR, respectively, a court must take it into account in proceedings for such an offence, as stated in regulation 41(10) HR and 39(8) OMR. Insofar as it provides guidance on the injury offence in regulations 41(1)(a) and 39(1)(a) of the HR and OMR, it may or may not be taken into consideration by courts.**

The following activities could, in certain situations, be associated with the disturbance or injury of marine EPS, primarily through the emission of anthropogenic sound and/or the potential to cause collision:

- Acoustic deterrent (or harassment) devices
- Acoustic mitigation devices
- Aggregate extraction
- Aircraft traffic
- Construction works (including pile driving, rock dumping, cable and pipe laying)
- Decommissioning, including well abandonment
- Drilling
- Explosive use
- Maintenance of navigation channels (including dredging and dumping)
- Military sonar
- Offshore renewables (energy generation from)
- Recreational activities
- Research on cetaceans
- Seismic and other geophysical surveys
- Shipping and vessel movements
- Whale-watching (including both commercial and recreational)

In the offshore area, if any of the offences occur during actions that were for the purpose, and in the course of, '**sea fishing**', the defendant shall not be taken deliberately to have caused the offences where he did not intend for them to occur and had taken reasonable steps to comply with requirements of relevant Community instruments (see OMR Regulations 39(9) to (11)). All activities related to sea fishing are regulated within the framework of the Common Fisheries Policy.

This defence does not apply to the HR (as amended 2009 and 2010), reflecting the powers available to Member States to regulate the activities of their own vessels within 12 nautical miles of baselines under the Common Fisheries Policy. In practice the removal of this defence should mean little change as fishermen who are fishing in accordance with the measures in the Common Fisheries Policy are unlikely to commit an offence under these Regulations. Clearly, however, if fishermen are found to be deliberately capturing, killing, injuring or disturbing protected species then they would be liable for prosecution.

In the next sections, a brief description is given of the activities with the potential to cause disturbance or injury, together with some information, where available, on the spatio-temporal extent of the activity and the risk of committing an offence. The main concerns regarding disturbance and injury and evidence relating to those effects are highlighted, together with a review of gaps in the knowledge and active areas of research. Finally, for each activity, the

existence or otherwise of good practice guidelines (mandatory or voluntary) is noted, together with their status and details of the bodies that are working on them. These guidelines can either be found in Annexes to this document or by following the links provided.

### *3.1. Acoustic deterrent and acoustic harassment devices*

Acoustic deterrent devices (ADDs) and acoustic harassment devices (AHDs) are underwater high-frequency sound emitting devices intended to deter or exclude marine mammals from certain areas. Although there are technical differences between the two types of devices, the terms are often used interchangeably. The main differences lie in the sound source levels and the purposes of use. The ADDs (or pingers), are generally low power devices (less than 150dB re: 1µPa at 1m) used on fishing nets to prevent entanglement by alerting the animals to the presence of the net; while AHDs (or scarers) produce high power sounds (more than 180dB re: 1µPa at 1m) and are usually used to permanently prevent seals from getting close to fish farm pens[32; 33].

The use of AHDs at fish farms to scare away seals has increased in the last decade. There are concerns about the effects of these devices on other species, particularly cetaceans that also frequent the area and might be sensitive to the sound. Effects could range from the device being just audible (in areas far away from the device) to hearing injury (at very close ranges), with a zone of a behavioural response somewhere in between (which if sustained could lead to disturbance under the Regulations). The significance of the effects will depend on the behaviour of the animals when exposed to the sound, the source level and spectrum of the device and, most importantly, for how long and how often the device is emitting the sound when the animals are in the area affected.

It is likely that affected species will react to the sound by moving away from the area, and there is evidence that some species can be displaced from areas where these devices are being used. A Canadian study reported a decline of killer whale sightings coincident in time and space with the installation of several high amplitude AHDs in salmon farms, whereas killer whale sightings were stable over the same period in a nearby area where no AHDs were in use. [10]. This study provided evidence of the abandonment of a specific portion of a recognised habitat for the population, i.e. a significant effect on the local distribution or abundance of the species, and **this effect would constitute a disturbance offence under the HR and/or OMR.** Nevertheless, the whales returned to the area when the AHD stopped being used, after 5 years, and it is not known whether there were any population-level consequences as a result of this displacement.

The effects of one type of these devices have also been tested experimentally on harbour porpoises in the wild. A very pronounced, highly significant, and almost immediate effect on the relative abundance and distribution of harbour porpoises in the vicinity of the AHD, up to distances of 3.5 km, was observed, with animals completely excluded from an area within 200-600m of the AHDs[11; 34].

The potential effect of these types of devices on cetaceans is an active area of investigation. The Scottish Aquaculture Research Forum has commissioned research, not only on their effectiveness as a predator control method but also on the potential effects of these devices on cetaceans. It is hoped that the output of this project will help to develop best practice recommendations for AHD use that are in compliance with national and international nature conservation requirements. Scottish Natural Heritage (SNH) is also planning to update their

"Salmon Farming and Predatory Wildlife - a code of practice", which will include advice on the use of anti-predator devices such as AHDs.

**In the UK, in areas of high and regular cetacean occurrence, the use of these devices should be avoided or they should be used for as short a period as necessary**. An assessment of the likelihood to commit an offence under the HRs or OMRs should be undertaken prior to the use of these devices and taking account of possible mitigation measures. This should be carried out in consultation with the relevant regulatory authorities and nature conservation advisers.

### *3.2. Acoustic mitigation devices*

Acoustic mitigation devices (AMDs) have yet to be developed and tested. The term can be employed to describe any underwater sound emitting device intended to exclude marine mammals from for instance, areas of exposure to high-intensity noise such as pile driving[33] or to alert whales to prevent ship strikes[35]. Whilst there is the potential to use common AHDs or ADDs as AMDs to exclude cetaceans from an area of high intensity noise, evidence on the efficacy for this purpose is still limited and there are no devices or acoustic signals that have been shown to consistently exclude marine mammals over the ranges required for effective mitigation. Work commissioned by COWRIE, the offshore windfarm industry research-funding group, has concluded that future AMDs are likely to offer benefits that cannot reliably be obtained using other mitigation measures, but further research is needed to test candidate signals, measure how different species respond to them, and quantify the level of risk reduction that could be achieved by AMDs, used on their own or as part of a larger mitigation process (see "Assessment of the potential for acoustic deterrents to mitigate the impact on marine mammals of underwater noise arising from the construction of offshore windfarms[x]").

Until further research is carried out, and for activities where the risk of injury or death cannot be considered to be negligible, JNCC, Natural England and CCW currently recommend the use of ADDs as tentative acoustic mitigation devices. However, their use should be short-term (for example, during an appropriate watch period prior to an explosion) and always additional to the main mitigation measures, such as those used in marine construction related operations (Annex B) or during the use of explosives (Annex C). If used for a **short period of time**, t**hese devices are unlikely to affect any EPS in a way that would result in disturbance or injury under the HR/OMR.** It is therefore expected that, as far as possible, these devices would be used under conditions that would prevent the exposure of animals to disturbance that would constitute an offence under regulations 41 and 39 of the HR and OMR, respectively. It should be noted that a wildlife licence under the Wildlife and Countryside Act 1981 (within 12 nm) might be required to authorise a potential intentional disturbance.

### *3.3. Aggregate extraction*

Marine aggregate extraction in the UK became more common in the latter part of the 20th century, following a general decline in accessible land-won material, and it is anticipated that demand for offshore aggregates will continue to increase. Sand and gravel are generally taken from the seabed by trailer-suction hopper dredgers that are capable of transporting the cargoes

[x] Gordon J, Thompson D., Gillespie D., Lonergan M., Calderan S., Jaffey B., Todd V. 2007. Assessment of the potential for acoustic deterrents to mitigate the impact on marine mammals of underwater noise arising from the construction of offshore windfarms. COWRIE report

from offshore dredge sites directly to the unloading wharves located close to the point of use. The dredge areas are licensed by the Crown Estate. The regulatory consents and the related Environmental Impact Assessments (EIAs) and stakeholder consultation processes are undertaken in England by the Marine Management Organisation (MMO) Marine Environment Team and by the Welsh Assembly Government (WAG) Marine Consents Unit in Wales, pursuant to the legislative regimes in place[xi]. In 2006, the total area of sea bed licensed for marine aggregate extraction was 1,316 $km^2$, comprising about 70 production licence areas[36]. The total area actually dredged was 141 $km^2$ and 90% of dredging effort took place within 49 $km^2$. Marine aggregates are currently extracted from waters off the English and Welsh coasts, and there is no marine aggregate dredging in Northern Ireland or in Scottish waters.

Dredging operations can be a source of high intensity sound in the marine environment, dominated by energy at low frequencies which can be transmitted for long distances, but with some high frequency tonals[38]. Studies have indicated the possibility of behavioural impacts on cetaceans, in some cases with animals leaving an area where dredging is taking place. The sensitivity of fish to noise associated with dredging operations has also been discussed in the CEFAS report 'Preliminary investigation of the sensitivity of fish to sound generated by aggregate dredging and marine construction'. In this study, measurements of transmitted noise were taken 50m from a vessel whilst it was conducting full dredging activities and indicated a noise level of 117dB re: 1 µPa at 200 Hz with maximum noise levels of 126 dB re: 1 µPa occurring at 400 Hz. Both of these measurements suggest that the noise generated whilst dredging would fall below the levels that could cause injury to marine mammals (or fish). The likelihood of a disturbance offence is also low, since the area affected is very small and so the likelihood of exposure can be assumed negligible. One of the current aims of the Marine Aggregate Levy Sustainability Fund (MALSF) is to 'increase understanding of the effects of aggregate dredging activities, including noise, and its significance'. A recent study by CEFAS 'A generic investigation into noise profiles of marine dredging in relation to the acoustic sensitivity of the marine fauna in UK waters with particular emphasis on aggregate dredging: Scoping and review of key issues' has now been published.

It is recommended that the dredging operations applicant should also consider the likelihood of marine EPS occurring in the area and the potential impacts of the activity on those species, including the likelihood that the activity could result in a disturbance offence.

There are no specific good practice guidelines on how to mitigate the risk of disturbance of marine EPS during this activity since the risk is mostly considered negligible given the limited extent of this activity. Mitigation measures associated with this activity are normally aimed at reducing the impacts on the seabed and associated benthos and the effects of suspended sediment concentrations. However, **if the scale of aggregate extraction in UK waters increases significantly, particularly in areas where animals could become chronically exposed,** i.e. areas where there are small populations of coastal bottlenose or Risso's dolphins, **then the assumption of negligible risk would have to be revisited.**

[xi] In England and Northern Ireland marine minerals extraction is regulated through The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) (England and Northern Ireland) Regulations 2007; and in Wales through The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) (Wales) Regulations 2007.

### *3.4. Aircraft traffic*

Low flying aircraft and helicopters are mostly used by the military and the oil and gas industry. They are also used in some countries for whale-watching and cetacean observation to mitigate against potential adverse effects of other activities, but this is not known to occur in UK waters. Low flying aircraft and helicopters have the potential to result in behavioural changes to marine mammals that are near the surface, and in particular baleen whales, since the lower frequency range of their hearing is closer to the range of frequencies in aircraft noise. Aircraft noise can also transmit through the sea surface if flying at low altitude. Short-term behavioural responses to helicopters and fixed-wing aircraft flying at low altitudes of around 50m have been observed for bowhead whales and beluga whales[39]. The effects of aircraft noise will be restricted to a brief shallow 'footprint' directly below the aircraft and it is considered that **the sporadic exposure of cetaceans to low flying aircraft is unlikely to cause disturbance in the terms of the Regulations**. Currently, no good practice guidelines relating to mitigation of the impacts of aircraft noise on marine EPS exist in the UK, since this is considered of low concern and the risk of offence is negligible. Guidelines have been developed in some countries where aircrafts are used for whale-watching.

### *3.5. Construction works (including pile driving and rock dumping)*

Construction works in or near the sea, such as those involved in building harbours and marinas, offshore oil industry facilities and offshore windfarms, etc, may involve the use of pile driving and rock dumping. In a few cases, explosives may also be used (see section 3.8).

In addition to the effects arising from the deposit of materials, such as loss of habitat, construction activities may create high intensity underwater sounds. The MMO's Marine Environment Team licenses a number of marine construction works involving deposits of materials or articles in the sea or under the seabed. The majority of the applications are for Food and Environment Protection Act (FEPA) 1985 licences and Coast Protection Act (CPA) 1949 consents[xii]. In order to obtain a licence and/or consent it may be necessary to carry out an EIA.

In addition to FEPA licences, the construction of offshore windfarms requires other consents, most notably from the Department of Energy and Climate Change (DECC) under s.36 of the Electricity Act 1989. The construction of offshore windfarms, and other renewable energy developments in the marine environment, such as wave or tidal power devices, is likely to result in a large number of new marine construction works in the next decade and beyond. Plans for a major expansion of offshore windfarms in the UK have undergone a Strategic Environmental Assessment (SEA), and additional guidance for the project-level windfarm EIA is available from CEFAS.

Oil and gas construction works in England and Wales and the UK offshore marine area are consented by DECC under a different regulatory regime, that incorporates both an SEA and project-level EIAs.

[xii] The power to licence deposits in the territorial sea adjacent to Wales (other than in relation to matters concerning or arising from the exploration for, or production of, petroleum), rests with the Welsh Ministers under the Food and Environment Protection Act 1985. However, the MMO currently administers FEPA applications on behalf of the Welsh Assembly Government.

*Pile driving*

Pile driving involves forcing a supporting or retaining structure into the sea-bed using a hydraulic hammer. This is associated with many offshore construction activities, most notably oil and gas developments and the construction of offshore wind farms. Harbour developments, bridges and the installation of navigational aids can also involve the installation of piles.

Pile driving may result in the generation of substantial levels of underwater noise. This can be transmitted into the water column directly and also indirectly through the substrate. The level of this noise will depend on the size and maximum operating energy level of the hammer, the diameter and length of the piles, the seabed conditions (e.g. substrate hardness). Physical factors such as water depth, bathymetry, and salinity will influence sound propagation, and the levels of noise at different ranges from the pile-driving source seem to be highly dependent on the propagation characteristics of the environment[40]. Piling noise (source levels) for piles with a diameter of between 4 and 4.7m has been estimated to range from 243 to 257 dB re 1 Pa @ 1m, with an average value of 250 dB re 1 Pa @ 1 m[41]. Low frequency sounds dominate pile driving.

Although no direct evidence exists for a causal link between pile driving sound and physical injury to cetaceans, data on auditory sensitivities and comparison with human and other terrestrial mammal data suggests that pile driving in the marine environment without mitigation is likely to produce noise levels capable of inducing avoidance reactions that could constitute disturbance under the Regulations, and injuries (e.g. physical damage or hearing impairment) or even death in marine mammals that are in very close proximity[xiii]. In addition to these effects, exposure to sound may also result in non-auditory physiological effects such as stress and tissue injury. **Given the risk for injury and disturbance offences under regulations 41(1)(a) and (b) and 39(1)(a) and (b), of the HR and OMR, respectively, appropriate mitigation should be sought and employed where possible in order to reduce the risk to negligible levels.**

Annex B provides a general protocol for the mitigation of noise from pile driving during construction of an offshore windfarm. Early consultation with the regulatory authority and relevant nature conservation agency is advisable so that the most appropriate mitigation package can be discussed and planned. This could range from simply having a member of the ship's crew making sure the area is clear of cetaceans before starting piling for very small scale activities in areas where cetaceans are less likely to occur, to comprehensive mitigation. Mitigation should be, and usually is, included in the project proposal by the developer, and then further developed as part of the EIA process.

[xiii] For an assessment of noise levels and potential impacts associated with offshore windfarm construction please refer to COWRIE (www.offshorewind.co.uk) commissioned work including:
- A review of offshore windfarm related underwater noise sources.
- Effects of offshore wind farm noise on marine mammals and fish.
- Assessment of the potential for acoustic deterrents to mitigate the impact on marine mammals of underwater noise arising from the construction of offshore windfarms.
- Assessment and costs of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore windfarms
- Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters (December 2007)

The MMO has adopted standard FEPA licence requirements for the use of soft start (where the hammer energy is gradually increased); the use of marine mammal observers (MMOs); and passive acoustic monitoring (PAM), to mitigate the impacts of pile driving associated with the installation of 'Round 2' offshore wind farms. In such cases, MMOs would be used for the detection of marine mammals, basking sharks and turtles within a monitoring zone, and/or PAM might be used to detect the presence on vocalising marine mammals. Appropriate protocols would additionally specify how construction activities should take place. For example, a licence condition might stipulate that piling activities should not commence until half an hour after any detection of marine mammals in or around the monitoring zone. Even though the effectiveness of these **mitigation measures** has not been and may not be able to be fully tested, they are based on reasonably conservative assumptions. **It is considered that having these measures in place should reduce the risk of injury.** It should, however, be noted that additional measures would probably be required in areas where the environmental impact assessment identifies high cetacean densities or site-fidelity and there is a risk of disturbance.

Effects such as aversion reactions or the masking of vocalisations may also occur as a result of the noise produced during pile-driving. For example, observations of harbour porpoise behaviour during pile driving have indicated temporary displacement from an area within 10-15km of pile driving[7-9]. This species seems to be particularly sensitive to multi-pulsed sounds[6].

Based on current evidence it seems possible that pile driving for extended periods will impact on individuals, and impacts on populations of certain species cannot be discounted[42;43]. Additional references to the limited number of studies on the effects of pile driving noise on cetaceans can be found in Madsen *et al.* (2006), and in reports commissioned by COWRIE.

There is a wide range in pile sizes, lengths, and the duration of piling, depending on the type of construction and the substrate. Whether the effects will be sufficient to reach the threshold for disturbance under the Regulations will depend first and foremost on the temporal and spatial scale of the activity and also on the pattern of a species distribution in the affected area. Pile driving is a static activity that may take place for a short period of time, but many piles may be required for some constructions. During the construction of an offshore windfarm, piling may take place from late spring to autumn over a two year period (i.e. two construction seasons). This could lead to chronic sound exposure for animals that show some site fidelity to the affected area, or to the displacement of animals (e.g. harbour porpoises) from a large area for a considerable period of time (which could be longer than they would normally be absent). **Both of these effects could be regarded as disturbance in terms of the Regulations and, if these risks cannot be avoided or reduced, the developers may need to obtain a licence under regulations 53/49 (HR/OMR respectively) in order to avoid the application of regulation 41/39 of the HR/OMR (and commission of an offence under regulation 41/39).** Given current plans for the construction of extensive windfarms in the central/southern North Sea, if pile driving constitutes the preferred foundation method, then the risk of cumulative and in-combination impacts on the harbour porpoise population needs to be assessed.

For piling associated with offshore oil and gas industry developments, the assessment of the potential impacts of the operations should be included in the EIA required under the Offshore Petroleum Production and Pipe-lines (Assessment of Environmental Effects) Regulations 1999 (as amended in 2007). DECC is responsible for most consents relating to this industry,

taking account of advice provided by the nature conservation agencies, and guidance is available on the DECC website. As part of the EIA process applicants must describe the potential impacts and the proposed mitigation, and the mitigation proposed for pile driving during the construction of offshore windfarms in Annex B can be implemented, depending on the nature of the planned operation.

For noise resulting from the operation of offshore windfarms see section 3.11. Offshore Renewables.

*Rock dumping*

Rock dumping can be used for a variety of purposes, for example for burying and stabilising pipelines, as scour protection or in connection with marine construction works such as the building of a harbour, and is likely to produce noise. For activities other than those associated with the oil and gas industry, applications (as described above) would be made to the MMO[xiv], and, where appropriate, an EIA would be carried out. For activities associated with the oil and gas industry, the assessment of the potential impacts would be included as part of the offshore oil and gas EIA procedures. Following completion of those procedures, the permanent placing or deposition of materials such as gravel, rock, concrete mattresses or protective pipeline covers on the seabed during the construction or maintenance of an offshore oil or gas pipeline would be the subject of a Pipeline Works Authorisation (PWA) issued under the Petroleum Act 1998.

All rock dumping proposals should include an assessment of the likelihood of an injury offence, and depending on the area affected and the duration of the activity, an assessment of the likelihood of disturbance. No data are available on what the noise levels generated by rock dumping might be; however this operation will typically be of short-duration, and there will be a low likelihood of committing an offence.

## *3.6. Decommissioning, including well abandonment*

When offshore installations reach the end of their useful life, a decommissioning programme will be produced by the operator for agreement with the UK Government, detailing the fate of the installation. Removal could involve cutting up the structure using a variety of tools or explosives. Non-explosive cutting technology produces relatively little noise, whilst the use of explosives can potentially cause disturbance, injury and even death of cetaceans (see section 3.8 on explosive use). Advances in cutting technology have reduced the use of explosives in recent years, but there are still a large number of suspended well heads and production structures that will need to be decommissioned.

Offshore renewables (windfarms and tidal and wave power) decommissioning could also potentially impact marine EPS. Developers are required to submit a decommissioning plan under s.105 Energy Act 2004, which would have to be supported by an EIA.

**An assessment of the likelihood to cause injury to a marine EPS should always be included in the decommissioning programme and supporting EIA, and appropriate mitigation put in place.** This could range from simply having a member of the ship's crew making sure the area is clear of cetaceans before starting the operations, to more comprehensive mitigation strategies including the use of dedicated marine mammal observers

[xiv] Currently the MMO administers FEPA applications in Welsh waters on behalf of the Welsh Assembly Government. However, this will be transferred via a phased handover starting in late 2009.

and passive acoustic monitoring. **Deliberate disturbance as in the terms of the Regulations is unlikely given the comparatively short duration of most noise-generating decommissioning operations.**

### *3.7. Drilling*

Drilling is mainly associated with the offshore oil and gas industry, although it can be used as part of other offshore construction works or for test boreholes. In the oil and gas industry, drilling can be used for exploration, appraisal or development wells. Exploration and appraisal drilling will usually be carried out from mobile drilling units, i.e. jack-up rigs, semi-submersibles or drill ships. These may be located using anchors or dynamic positioning systems (except jack-ups). Development drilling, and subsequent well maintenance, will either be carried out from a fixed offshore platform situated over or adjacent to the reservoir, or using mobile drilling units. Drilling will involve a series of incidental activities, such as aircraft and vessel support, all of which will contribute to a noise signature around the area of drilling. Drilling noise is generally of low concern to cetaceans[38], but the noise levels depend on the type of drilling facility employed. In particular, the use of dynamic positioning systems should be given special consideration within the EIA, as this will result in an almost constant source of additional noise. The temporal scale of drilling activity varies, but it is usually in the range of two or three weeks to three to four months. The overall pattern of drilling noise production by the oil and gas industry will be one of fairly continuous background noise in the main production areas, and sporadic noise in the exploration areas (although there is a large overlap between the two). The sound produced is mostly of low frequency, with highest levels being recorded from drilling vessels[38], and lowest levels associated with production platform drilling operations.

In the UK, no guidelines exist for mitigating the sound from drilling activities since these are thought to be of relatively low concern for cetaceans. However, for large scale drilling operations**, particularly in areas where animals could become chronically exposed,** e.g. areas where small populations of coastal bottlenose dolphins or Risso's dolphins occur, **an assessment of the risk of deliberate disturbance should be carried out and consideration given to whether appropriate mitigation is feasible.**

### *3.8. Explosive use*

Explosives can be used in the course of a number of offshore activities, for example during the decommissioning of offshore platforms. Pressure pulses from explosions can have higher peak levels than those from any other man-made source, and very rapid rise times[38]. At close distances, explosives also produce shock waves. Underwater explosions have the potential to cause injury or even death of cetaceans. In terms of short-term behavioural changes, some species are likely to be more affected than others. For example, a study has observed sperm whales showing no reaction to distant detonations resulting in received levels of up to 179 dB rms re 1 µPa[44] (although this was based on a small sample size). For a critical review of recent studies on the short-term responses of cetaceans to underwater explosions, see Nowacek et al. (2007)[32].

For activities that make use of explosions for a relatively short period of time, **it is considered that there would be a low likelihood of disturbance occurring that would constitute an offence under the HR and OMR**. The main issues of concern in these circumstances would be the **risk of death and injury** to a cetacean in the vicinity of the blast

area. However, suitable mitigation measures might reduce the risk of this offence being committed.

The JNCC has produced "Guidelines for minimising the risk of injury to marine mammals from explosive use" (see Annex C). Operators applying to use explosives in UK waters should adopt these generic guidelines, making any necessary adaptations as an integral component of their mitigation measures. A site-specific Environmental Protection Plan (EPP), which will include the details on the mitigation measures to be employed, should be included in any decommissioning programme prepared under the Petroleum Act 1998 that involves the use of explosives. Guidance on decommissioning activities associated with oil and gas facilities can be found on the DECC website.

### *3.9. Maintenance of navigation channels (including dredging and dumping)*

Maintenance dredging is necessary to maintain safe navigation depths to and within harbours and marinas. Main concerns relate to low-frequency noise during dredging[38]. Dredgers can be a source of strong continuous noise for long periods of time, particularly in near shore regions[38]. The source levels and characteristics of sound produced by dredging are likely to vary with dredger type and phase of operation. However, it is likely that in many navigation channels the ambient noise caused by shipping will still exceed the dredger noise.

There are no specific good practice guidelines on how to mitigate for the potential impacts to marine EPS during this activity since **the risk of injury is considered negligible**. However, **an assessment of the likelihood of disturbance occurring as a result of the activity** should be undertaken by those responsible for dredging **in areas where there is a risk that animals could be chronically exposed to the dredging noise**, e.g. areas where small populations of coastal bottlenose dolphins or Risso's dolphins occur. See also section 3.3 on aggregate extraction.

### *3.10. Military sonar*

The low- and mid- frequency military sonar operate at between 300-3,000 Hz and between 3,000 and 10,000 Hz respectively[14], which fall within many cetacean species' hearing ranges. Sounds at these frequencies, coupled with high source levels, can give rise to potential impacts over large areas (from injury to disturbance), since low frequency sounds travel farther. There is currently no available information on the extent of use of these types of sonar, although it is likely that the use of mid-frequency sonar was far more widespread in the past.

It is generally agreed that some mid-frequency sonar may impact on the survival of individuals of certain beaked whale species[45], following cases of mass-strandings and mortality which coincided with military sonar trials[21; 46]. Even though the mechanisms leading to the beaked whale mortality are unclear, the pattern of the species affected and the implicated sound indicate a link which is being investigated further. Recent observations suggest that animals may develop decompression sickness[21; 22] due to an alteration of diving behaviour in response to sonar signals. However, it seems that the animals do not always respond in such a dramatic fashion to these sounds and research is ongoing to determine what factors may affect the response.

In order to reduce the potential for injury and disturbance to cetaceans caused by military sonar, the UK Ministry of Defence (MoD) has developed best practice approaches and undertaken a number of measures, which include internal environmental assessments, research into the effects of active sonar, development and application of technologies to help mitigate the risk to the environment, development of passive acoustic marine mammal detection, classification and localisation, modelling of marine mammal abundance and distribution, and physiological modelling.

Mitigation measures associated with the deployment of active sonar being developed and applied by the UK MoD include sonar operated in a way that minimises the risk to the hearing and internal organs of different animals (e.g. by beginning transmissions at low output levels to give marine life the opportunity to move away); cessation of sonar operations if marine mammals are within a predetermined safe range; and the use of Marine Mammal Observers to continuously monitor the operational area.

The UK MoD also continues to develop an Environmental Risk Management Capability (Sonar) system, known as "Sonar 2117", which should provide a robust, repeatable and transparent method of assessing the environmental risk to, and impact on, marine life caused by sonar activity, and provide advice to manage the potential impact through mitigation measures. **If a series of mitigation measures are used appropriately and areas where sensitive species might occur are avoided, the risk of deliberate injury and disturbance might be considered negligible.**

### *3.11. Offshore renewables (energy generation from)*

This is an emerging marine activity based on generating energy from the wind, tides and waves by using offshore installations. Structures are placed in areas of high energy tidal streams or range, or in areas where there is sufficient wave or wind energy for power generation. While, generally, the operation of current offshore windfarms is not considered likely to impact on EPS (including disturbance given the low sound source levels), this may not be the case with the scaling up of windfarms[47] or for emerging technologies such as wave and tidal generation devices. These are novel interventions in the marine environment and their environmental impacts are not well studied.

Potential impacts may arise from physical collision with moving components or structures or from the noise generated by the operation of tidal and wave devices. The potential impacts of tidal and wave energy developments on cetaceans were assessed as part of the Scottish Marine Renewables Strategic Environmental Assessment programme. This programme undertook a preliminary assessment of the risk of collision of harbour porpoises with the moving parts (e.g. turbine blades) of a tidal device on the west coast of Scotland[xv]. It was estimated that within one year a large number of encounters with this device could take place, but this does not necessarily equate with potential collision as it is not known whether the animals would become attracted or avoid the moving parts. Avoidance rates will be critical in determining the assessment of the collision risk and research is ongoing on the behaviour of cetaceans in response to these devices[43].

[xv] Wilson, B. Batty, R. S., Daunt, F. & Carter, C. (2007) Collision risks between marine renewable energy devices and mammals, fish and diving birds. Report to the Scottish Executive. Scottish Association for Marine Science, Oban, Scotland, PA37 1QA.

Noise will be generated when the marine renewable devices are in operation, although in many cases, and particularly for the smaller toothed whales, the audibility of the operational noise of these relatively small turbines will be restricted to close ranges. The effect of operational noise on cetaceans with lower frequency hearing (e.g. minke whales) is unknown[47]. For tidal or wave devices, further work is needed to assess the level and characteristics of the noise produced, and the significance of those levels. This should include measurements of newly installed systems and aging machinery, since it is likely that the noise radiating from these systems will increase through their operational life.

For wind turbines, the lack of serious concern in relation to operational noise is based on measurements from the turbines presently in operation. These data may not be representative of future, larger, and potentially noisier turbines[47]. The impact of the scaling upwards from small scale windfarms to larger arrays of turbines therefore requires further research. Noise generated by vessels servicing the installations will also add to the noise signature in the area of the activity.

Currently there are no environmental guidelines available for "wet" renewables (tidal and wave), although these will be developed as a result of current studies and monitoring and as the industry matures and an understanding of the potential impacts is obtained.

### *3.12. Recreational activities*

Recreational activities with the potential to cause death, injury or disturbance to marine EPS (particularly cetaceans) include a variety of different types of vessels, including: sailing, motor boating, water skiing and personal watercraft (e.g. jet skis). Main areas of concern relate to collisions with vessels and engine noise. There has been little research carried out into the impact of these activities. Whilst disturbance more akin to harassment can be fairly straightforward to detect (and could be an offence only under the WCA), the longer-term impacts to cetaceans exposed to high and persistent levels of these types of activities remain unknown.

A joint project between the Royal Yachting Association (RYA) and the British Marine Federation, The Green Blue, aims to promote the sustainable use of coastal and inland waterways and the sustainable operation of the recreational marine industry. The Green Blue has also produced a fact sheet pulling together the results of research into the effects of boating and water sports on wildlife. **It includes best practice advice which, if followed, should reduce the risk of injury and short-term disturbance from individual watercraft to negligible levels.**

**Power boat races could result in injury or death (offence under the HR and OMR) or short-term behavioural changes to marine EPS (which could constitute an offence under the WCA).** Spatio-temporal and speed restrictions might be necessary and should be agreed between those responsible for the race and the nature conservation agencies well in advance of the race. The use of marine mammal observers might also be necessary. Competitors should be aware of the potential impacts on marine EPS and of the mitigation measures to be adopted.

See also section 3.16. Whale-watching.

### *3.13. Research on cetaceans*

**Research at sea to study cetaceans may have the potential to cause injury and short-term disturbance through approaches to animals by research vessels**. The main risks to the animals arise from collision potential and noise generation. Research vessels may need to approach groups of cetaceans to observe the animals, obtain high quality photographs, and/or collect biopsy or faecal samples. However, **provided that speed restrictions or other collision risk minimisation measures are applied, the risk of an injury offence should be reduced to negligible levels.**

Individual animals may be approached several times during one single survey and surveys might occur regularly throughout the year. Examples of this include photo-identification work, which is carried out regularly throughout the year or in the season the animals are known to occur in an area. Whether non-trivial disturbance could result from conducting research on cetaceans at sea will greatly depend on the existence of other pressures, cumulative and in- combination effects, and the scale of the activity(ies) proposed. **From the perspective of an individual research activity however, it is unlikely that a disturbance offence will be committed** if appropriate measures are applied. These may include limiting close approaches to the animals to as short a period as possible and a restricted seasonal search effort.

CCW for example has issued a protocol for minimising the risk of injury and disturbance to cetaceans when carrying out photo-identification studies. It is compulsory in Welsh waters to follow this protocol as a condition of a wildlife licence (under the WCA and the HR). In the UK, there are no other formal guidelines to minimise the risk of injury or disturbance to cetaceans when carrying out research in the field.

### *3.14. Seismic and other geophysical surveys*

Geophysical exploration is often carried out using seismic airguns. In addition, sub-bottom profilers such as sparkers or boomers can be used to provide high resolution geophysical profiles, and sonar (e.g. sidescan sonar) is widely used to map seabed morphology.

*Seismic surveys*

Seismic surveys are carried out in the United Kingdom Continental Shelf (UKCS), most commonly in the search for, and management of, oil and gas reserves. Modern large-scale surveys are conducted using a towed array of 'airguns' – cylinders of compressed air. The array will typically contain tens of such cylinders. The airguns are discharged to generate a pressure pulse which travels downwards into the seabed. The pulses, reflected back from the seabed and underlying strata, are recorded, interpreted and plotted. As the survey proceeds, the airguns are fired and recharged with compressed air at regular intervals of approximately ten seconds, the timing dependent on the objectives of the survey. The seismic sources are normally not active 24h a day, as they are either stopped or reduced to a minimum while the vessel moves from the end of one line to the start of the next.

A seismic survey can last for many weeks in an area, and the **main area of concern with regards to seismic activity relates to the high intensity multiple pulsed sound produced by the airguns, which have the potential to cause injury and disturbance.** Physical collision is unlikely to be an issue for seismic surveys, since the vessels normally operate at low speeds of less than 6 knots. However, although no direct evidence exists for a causal link between airgun sound source and physical injury to cetaceans, data on auditory sensitivities

and comparisons with human and other terrestrial mammal data suggest that cetacean hearing could be damaged by the source levels emitted by airguns if the animals are very close to the guns. There is also evidence for short-term behavioural responses of marine mammals to seismic surveys[5; 20; 48; 49], such as sustained avoidance of the area shown by some species of baleen whales[5; 50]and small toothed whales[20]. However, at present, there is little direct evidence for biologically significant effects that would be likely to amount to disturbance under the Regulations. This could be because investigating such effects has proven very challenging[16; 48].

Information on the effects of seismic surveys on cetaceans can be found for example in Gordon *et al.* (2004)[48], Stone and Tasker (2006)[20] and Southall *et al.* (2007)[5]. Airgun arrays typically produce short duration multiple pulse sounds with high peak source levels (220-255 dB re: 1µPa, zero to peak, back-calculated at 1m)[38]. This level of sound is however, considered an overestimate of the true output since it is not based on actual empirical measurements but on modelling. In addition, measured sound levels within a few hundred metres of seismic sources have generally been less than 200 dB re: 1µPa (RMS)[5].

The sounds produced are low frequency broadband pulses, with the bulk of the energy concentrated around 100 Hz, but with a frequency band that can range from below 50 Hz to above 1 kHz . Therefore, even though the loudest sounds produced (around 100 Hz) will probably be heard mainly by species of baleen whales (since their vocalisations and assumed hearing sensitivity fall within the frequency bands with the highest source levels of airgun sounds), there is some evidence that species from the other two functional groups (medium and high frequency) also detect those sounds and may change their behaviour as a response[51;52]. Evidence of avoidance or short-term behavioural responses is mixed; and varies depending on the species, location and animal behaviour at the time[32;38;53]. Even though the effectiveness of **mitigation measures** (see Annex A) has not been and may not be able to be fully tested, they are based on reasonably conservative assumptions. **It is considered that having these in place should reduce the risk of injury to negligible levels and potentially reduce the risk of short-term disturbance. Disturbance caused by individual seismic surveys will likely be mostly sporadic and without any likely negative impact on the species, hence unlikely to constitute an offence, given the transitory nature of individual surveys. Exceptions may include surveys with the potential to significantly displace animals from important habitats, or from large areas for longer periods than the animals would normally be absent.** Whilst there is no direct evidence, it is a possibility that non-trivial (biologically significant) disturbance could occur for some animals as a result of cumulative effects from exposure to noise produced by several seismic surveys over long periods of time. This possibility is being studied under the Joint Industry Programme ("E & P Sound and Marine Life").

The highest sound levels generated by seismic arrays are directed downward; nevertheless, a considerable amount of energy is radiated horizontally with the result that seismic arrays can be heard many kilometres from the source. There are some studies that have measured propagation of sound emitted by different types of airgun arrays for different regional settings. Some of these studies have found that the assumption of decreasing received levels with distance from the source does not hold in some habitats. Madsen *et al.* (2006)[52] found that, in the deep waters of the Gulf of Mexico, the received levels of airgun sound energy for sperm whales could be as high at 12km as at 2km, reinforcing the critical importance of regional characterisation of airgun sound propagation. Oil and gas stakeholders should work

together towards establishing appropriate propagation scenarios for specific areas/times, taking account of local environment characteristics.

The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended) implement the EU Habitats Directive for all oil and gas activities within the United Kingdom Continental Shelf (UKCS). Under these Regulations, any company wishing to carry out a seismic survey must apply for consent from the Department of Energy and Climate Change (DECC). The JNCC are consulted on each seismic survey, and if consent is granted the operator will be expected to take account of the "JNCC Guidelines for minimising the risk of injury to marine mammals from seismic surveys" (Annex A). Specific requirements relating to those guidelines may also be included in the consent conditions. The guidelines are aimed mainly at minimising the risk of injury to animals that may be close to the airgun array at the beginning of the survey.

Another condition of the consent to carry out a seismic survey is that a report is submitted to the JNCC for each survey, detailing how the JNCC Guidelines were implemented, the marine mammals sighted, the methods used to detect them and any problems encountered. A series of standard forms for recording these data has been developed, and the data are analysed by the JNCC. Seven reports on Marine Mammal Observations during seismic surveys for the years 1996 to 2002 have been published. In addition, a report on the Effects of seismic activity on marine mammals in UK waters, 1998-2000 and a related scientific paper (Stone and Tasker, 2006) have been published, and another report is planned to analyse the data from 2003-2006.

The International Association of Oil & Gas Producers has assembled a programme of work within a Joint Industry Programme ("E & P Sound and Marine Life") aiming to identify knowledge gaps, increase understanding and mitigate the effects of underwater sound on marine animals. The knowledge obtained should inform the regulation of seismic surveys and reduce areas of uncertainty.

*Multibeam and side scan sonar surveys*

Multibeam and side scan sonar systems record a 2D view of the seabed to study its morphology. Multibeam systems are characterised by the broad width of the swath each side of the vessel. These emit very short (0.2-20 milliseconds) transmit pulses with a repetition rate that could vary between a 4-8 second repetition rate to 10 pulses a second for very shallow waters. These range in frequency from those lower than 10kHz to more than 200kHz depending on the depth they operate in; and source levels that could be as high as ~236 dB re: 1 µPa @ 1m[54]. For those multibeam systems operating in mid range and full ocean depth, there is a **potential to cause injury or short-term disturbance to some cetacean species at very close proximity, and the likelihood of an offence should be assessed with mitigation measures put in place as appropriate. Again, disturbance under the Regulations would be unlikely as a result of this type of survey, if carried out for a short period of time.** For those multibeam systems operating in shallower waters, and because the frequency range they operate in falls outside the hearing threshold of cetaceans, attenuates more quickly than lower frequencies and these operate on lower power**, it is unlikely that they could cause injury or any disturbance.**

No guidelines exist for the use of multibeam systems in the UK. Nevertheless, if it is concluded that an injury offence is likely as a result of the use of these systems, then

mitigation should be applied as appropriate. The JNCC guidelines on seismic surveys (see Annex A) can be adapted and applied to the operation of such systems.

Side scan sonar operates at higher frequencies (typically around 100-500 kHz). The high frequencies produced are again outside of the hearing thresholds of cetaceans, even of harbour porpoises (1.4 - 2.5 kHz for communication and sonar-clicks at 110 - 140 kHz), and well above the hearing level of other marine mammals. Additionally, and although sound output levels are relatively high (around 200 dB re: 1 µPa-m), because of these high frequencies (which attenuate more quickly than lower frequencies), the levels of sound will fall off rapidly away from the source. The intermittent nature of side scan sonar signals results in lower noise doses than would occur for continuous signals. All the previous factors combined[14;54], together with the fact that **this type of survey is of a short-term nature results in a negligible risk of an injury or disturbance offence (under the Regulations)**.

*Sub-bottom Profiling (pingers, boomers, sparkers and chirp systems)*

Sub-bottom profiling equipment is used to image the seabed and can identify the complexity of the soils. The type and resolution of the information required will determine the chosen system. 'Pingers', named due to their acoustic 'pings', operate on a range of single frequencies between 3.5 kHz and 7 kHz. "Boomers" have a broader band acoustic source ranging between 500 Hz to 5 kHz. Although less commonly used today, 'Sparkers' are powerful instruments that generate lower frequencies for maximum penetration. 'CHIRP' systems are more modern and designed to replace the 'pingers' and 'boomers'. CHIRP systems operate around a central frequency, but are swept electronically across a range of frequencies (i.e. a 'chirp') between 3 kHz to 40 kHz.

There is little published information on the sound pressure levels generated from sub-bottom profiling equipment, either from field experimentation or from manufacturers' specifications. Examples of sound pressure levels (SPL) recorded from a boomer operating at 350 joules are 204 dB re $1_{\mu}$Pa RMS at 1m, and from a mini-sparker operating at 1.5 kilojoules are 209 dB re $1_{\mu}$Pa RMS at 1m[xvi]. The actual SPL generated will depend upon the type of equipment used and its operating specification, which will vary on a case-by-case basis. In addition, most of the sound energy generated will be directed downwards to the seabed and the pulse duration of these sub-bottom profilers is extremely short, in the order of tens to hundreds of milliseconds, with the survey constantly moving. The lower frequencies generated are within the hearing range of marine mammals; therefore, this could, in a few cases, cause localised short-term impacts on behaviour such as avoidance. However, it is unlikely that this would be considered as disturbance in the terms of the Regulations[54]. **It is unlikely that injury would occur as an animal would need to locate in the very small zone of ensonification and stay in that zone associated with the vessel for a period of time, which is also unlikely.**

No guidelines exist for the use of sub-bottom profiling equipment in the UK. Nevertheless, if it is concluded that an injury offence is likely as a result of the use of these systems, then mitigation should be applied as appropriate. The JNCC guidelines on seismic surveys (see Annex A) can be adapted and applied to the operation of such systems.

[xvi] US Federal Register Vol 71, No. 189, 2006/Notices.

### *3.15. Shipping and vessel movements*

Many of the waters around the UK are subject to intense shipping activity, for example the English Channel (one of the busiest shipping lanes in the world), the Straits of Dover, the northeast of Scotland and the Irish Sea. Commercial shipping is a major contributor of low frequency (5-500 Hz) background noise in the world's oceans[55]. The number of ships in the world fleet has tripled in the last 50 years. Off California, shipping noise levels have been found to increase at a rate of approximately 3 dB per decade[56]. No such analysis has been undertaken in UK waters. Particular concerns relate to noise generated by propeller cavitation, thrusters (such as those used in dynamic positioning systems), and noise transferred to the ship's hull from the ship's engine and other systems. Vessels associated with marine activities will generate noise at the local level, adding to the noise signature of an activity.

Little is known about the potential impact on cetaceans of an overall increase in ambient noise levels related to the ever-increasing density of shipping activity. The masking of biologically significant sounds, such as intra-specific communication and the detection of predators and prey, is of most concern. The likelihood of disturbance, as defined in the Regulations will very much depend on the types of boats and on the cumulative effect of several boats operating in an area, or within the natural range of a population of a marine EPS. It will also depend on the species of cetacean, their behaviour, habituation, and their habitat[38; 57]. **It is most unlikely that a passing vessel would cause more than trivial disturbance. It is the repeated or chronic exposure to vessel noise that could cause disturbance in the terms of the Regulations.**

In addition to shipping noise, the possibility of collisions is also an area of concern in relation to the potential impacts of shipping on cetaceans, particularly in some parts of the world. Technical mitigation measures to reduce ship strikes are being looked at an international level, and these include the ability to detect whales in the path of the ships and avoid them, or the use of methods to make the whales avoid the ship's path (such as acoustic mitigation devices).

Shipping is regulated by the International Maritime Organisation, which now includes a formal correspondence group on shipping noise and marine mammals. An international symposium organised by the National Oceanic and Atmospheric Administration (NOAA) in 2004 discussed some of the progress in understanding and minimising the potential impacts of this activity on marine mammals - "Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology". Management of shipping noise also includes the development of vessel-quietening technologies, such as improved blade design for propellers and the mounting of machinery in a way to reduce transmission of noise through the ship's hull. NOAA's 2007 international vessel-quietening symposium report is available at www.nmfs.noaa.gov/pr/acoustics/shipnoise.htm. In addition, in certain areas of the world that are considered particularly sensitive, vessel speed or spatio-temporal restrictions have been put in place to reduce the risk of injury and disturbance.

In UK waters, the issue of injury through collision is not currently thought to be of major concern and so there are no specific mitigation measures in place. The risk of disturbance under the Regulations, as a result of the potential cumulative effect of shipping, requires further investigation as does the matter of whether in certain areas, particularly those where chronic exposure is a possibility, the adoption of guidelines and mitigation measures would be appropriate.

*Echosounders*

Echosounders are used in all ships and most other vessels, and constitute a very pervasive source of sound in the marine environment. They typically have a focused vertical beam, ranging in frequency between 8 and 300 kHz, with a maximum source level of 220 dB re 1 μPa @1m. Although they emit only moderate levels of sound with regard to their typical source level and duty cycle (and so would be unlikely to cause an injury offence), their frequency range overlaps with that of many odontocetes, and the significant number of navigational echosounders in use means that they contribute considerably to the overall underwater noise energy. **The risk of a disturbance offence from one vessel operating an echosounder is likely to be negligible**. However there could be a risk of disturbance, as defined in the Regulations, occurring as a result of the potential cumulative effect arising from several vessels operating in an area for long periods of time. This risk requires further investigation and whether in certain areas, particularly those where chronic exposure is a possibility, the adoption of guidelines and mitigation measures would be appropriate.

### *3.16. Whale-watching (both commercial and recreational)*

Whale and dolphin watching around the UK coast has increased dramatically in the past 20 years, as both commercial ventures are set up and the public has started to take an interest in watching the animals in their natural habitat. In some areas, large numbers of boats may operate, and the **potential for chronic exposure of cetaceans to noise resulting in disturbance under the Regulations can be high and should be assessed.**

Concerns regarding whale-watching impacts on cetaceans relate mainly to the noise generated by the closely-approaching vessels and to the risk of collision which could lead to injury and even death[58]. Accounts of short-term behavioural responses by cetaceans to whale watching vessel traffic abound. Recent research has shown that **the repeated exposure of individual animals to boat interactions may lead to significant displacement, and potentially to the lowered viability of some coastal bottlenose dolphin populations**[24; 58-62]. In addition, whale-watching has been cited as a likely contributing factor in recent population declines of southern resident killer whales in Canada[63]. In 2006, the scientific committee of the International Whaling Commission[xvii] stated that "The Committee agreed that there is new compelling evidence that the fitness of individual odontocetes repeatedly exposed to whale-watching vessel traffic can be compromised and that this can lead to population level effects".

In the UK, several codes of conduct and accreditation schemes are in place aimed both at the public in general and at commercial wildlife watching operators. **Although it is considered that the adherence to such schemes should, in principle, much reduce the risk of an injury offence and potentially of a disturbance offence, their effectiveness in terms of compliance and protection to the species should be tested and monitored.** It is possible that in certain areas additional measures might be necessary to limit animal exposure to the noise generated by the vessels. This could include limitations to the total number of boat-hours spent in proximity to the animals.

In 2006, as a result of the Nature Conservation (Scotland) Act 2004, Scottish Natural Heritage launched The Scottish Marine Wildlife Watching Code. This code was developed for those who watch marine wildlife in Scotland - whether from the shore or at sea. The code comprises

[xvii] See section 13.1. in http://www.iwcoffice.org/_documents/meetings/stkitts/CHREP58.pdf

recommendations, advice and information. The Scottish Code and its guidance have been incorporated into the WiSe (Wildlife Safe) courses, a UK wide training and accreditation scheme aimed at operators of passenger pleasure craft, wildlife cruise operators, dive boats and charter yachts who may come into contact with large marine wildlife such as whales, dolphins, basking sharks or seals. The countries' nature conservation agencies (NE, CCW, SNH and NIEA) advise compliance with this scheme.

Another set of guidelines, specific to the Moray Firth area, are part of the Dolphin Space Programme (DSP), an accreditation scheme for wildlife tour boat operators in that area. The aim of the DSP is to encourage people who go out to observe dolphins and other marine wildlife to "watch how they watch" and to respect the animals' need for space. The mission of the DSP is to be a model of excellence in responsible wildlife tourism and is intended to support the sustainable, positive development of marine wildlife watching in the area.

Any filming of cetaceans is likely to occur over a short period of time, but if this is carried out on a population already subjected to other close approach pressures (e.g. photo id, whale watching) it could add to the potential for disturbance under the Regulations. However, if existing good practice guidelines (e.g. those for whale watching) are followed, these might be sufficient to avoid a disturbance offence under the Regulations. Alternatives to filming from boats should also be sought and, if sufficient film material already exists, then there might not be a justification for the acquisition of further material.

# 4. The Species - Marine EPS

## *4.1. Cetaceans (dolphins, porpoises and whales)*

The following cetaceans occur in UK waters:

- Bottlenose dolphin, *Tursiops truncatus*
- Harbour porpoise, *Phocoena phocoena*
- White-beaked dolphin, *Lagenorhynchus albirostris*
- Short-beaked common dolphin, *Delphinus delphis*
- White-sided dolphin, *Lagenorhynchus acutus*
- Striped dolphin, *Stenella coeruleoalba*
- Risso's dolphin, *Grampus griseus*
- Killer whale, *Orcinus orca*
- Sperm whale, *Physeter macrocephalus*
- Long-finned pilot whale, *Globicephala melas*
- Minke whale, *Balaenoptera acutorostrata*
- Fin whale, *Balaenoptera physalus*
- Beaked whales
- Other baleen whales
- Uncommon and vagrant species

Activities that are likely to be relevant to this guidance will have the potential to affect more than one species of cetacean, but a **species-by-species approach** is needed to determine whether a proposed activity is likely to result in an offence being committed. The main reason for this is that different species may have different sensitivities (e.g. auditory sensitivities) or reactions to the same potential disturbance factor, which must be taken into account in any meaningful protection system.

The sensitivity to disturbance may be different depending on the animal's behaviour at the time, the season or its stage in its life cycle, and Article 12(1)(b) of the Habitats Directive takes this into account by stressing that disturbance should be prohibited particularly during periods deemed to be more sensitive (breeding, rearing, hibernation and migration). For cetaceans, however, very little is known on which biological activities might render animals more vulnerable to disturbance, or what periods or life-stages might be more sensitive. In addition, regulations 41(2) and 39(1A) of the HR and OMR, respectively refer to breeding, rearing and nurturing young, which could, at least for mature females of most cetacean species, occur throughout the year. For cetaceans in UK waters, and in contrast with some other parts of the world's oceans, there is also currently no evidence to indicate that particular areas are consistently important for specific purposes/behaviours. Hence, all UK waters to which the OMR apply and English and Welsh waters to which the HR apply should be treated equally for the purposes of assessing the likelihood that animals in an area could become impaired in their ability to survive, to breed or reproduce, to migrate, or to rear or nurture their young.

Cetaceans occur throughout UK waters. Some species are found more frequently on the continental shelf, others in areas of deep water, while others occur both inshore and offshore. Appendix III of this guidance lists the most common cetacean species in Annex IV (to the

Habitats Directive) that occur in UK waters. The UK's 2007 Favourable Conservation Status assessments under Article 17 of the Habitats Directive are included in this Appendix as well as abundance or population size estimates where these are available. General information on natural range, home range patterns, population structure, and spatio-temporal variability in distribution and abundance are provided for each named species below. The information presented in this section is a brief summary of existing general knowledge on species and populations. In addition to this information, advice may be available from the relevant nature conservation agency, including up-to-date and possibly local information on each species.

Despite the increased survey efforts of the last two decades, current knowledge of the spatio-temporal distribution of cetacean species in UK waters (and indeed European waters) is limited. The most comprehensive information, including maps of species occurrence at a coarse scale and some details on the spatio-temporal distribution and relative abundance of the most common cetacean species can be found in the *Atlas of cetacean distribution in the north-west European waters*. The Atlas was produced using data both from dedicated and opportunistic sighting surveys. There are however several limitations in this dataset. All of the distribution maps (available online at http://www.jncc.gov.uk/page-3987 and www.seawatchfoundation.org.uk), mask any inter-annual variation within the period covered (since data were collected over a period of two decades). In addition, monthly coverage is patchy and the wide variation in search effort will be reflected in the data at such a relatively fine temporal scale. Further information on cetacean distribution and abundance in UK waters can be found in the DECC's *Strategic Environmental Assessments* and in the cetacean chapter of the Mammals of the British Isles (2008)[64].

*Common species in UK waters*

**Bottlenose dolphin, *Tursiops truncatus***

Bottlenose dolphins occur over large parts of UK waters, in inshore coastal waters, on the continental shelf and further offshore. The current abundance estimates is of 8,000 individuals for UK and adjacent waters (shelf and shelf edge only)[3] and preliminary results from the CODA survey in 2007[65], estimated a total abundance in the (offshore) survey area to be 19,295 [95% CI=11,842-31,440]. A genetic study has indicated that bottlenose dolphins in the north Atlantic occurring in offshore waters may belong to a large oceanic population[66]. Although coastal populations around the UK are not genetically isolated, there is some evidence for geographic structuring[67]. The abundance in UK coastal inshore waters has been reported as between 300 and 500 individuals[68], consisting mainly of (semi) residents in two areas (Moray Firth: 129 [95% CI = 110-174] and Cardigan Bay: 213 [95% CI = 183-279]), and these populations should be considered separately to the offshore population in risk assessments.

In the North Sea, the bottlenose dolphins range considerably beyond the boundaries of the Moray Firth, occurring throughout coastal waters on the north-east of Scotland southwards to north England[4; 69], and the animals from Cardigan Bay are also seen further North in Liverpool Bay[68]. In addition, small groups appear to be semi-resident in waters off Cornwall (and Dorset) and around the western isles of Scotland[70-72]. Bottlenose dolphins commonly form schools of 2-25 animals, but occasionally number several tens or low hundreds, particularly in offshore deeper waters. In most areas, a certain degree of seasonality in

bottlenose dolphin abundance has been observed, even though animals might be present in every month of the year[69; 73].

While offshore bottlenose dolphins probably undertake long-distance movements and have large and variable home-ranges, in many inshore areas such as the ones referred here, animals may maintain definable, long-term multi-generational home ranges, i.e. individually identified animals could be observed several times during one year, or year after year in a particular area. Semi-resident coastal bottlenose dolphin populations in UK waters are potentially more vulnerable to chronic exposure to noise than most other populations of cetaceans. For example, in some parts of the world, the repeated exposure of individual animals to whale-watching vessels has been linked to displacement, and potentially to the lowered viability of some coastal bottlenose dolphin populations[24; 58-62]. Persistent sources of noise in areas where these populations occur therefore have the potential to cause disturbance under the Regulations. When that risk cannot be avoided or reduced to negligible levels, then a licence would be required for the noise producing activity to go ahead. Given the significance of even one animal for these small populations, a highly detailed assessment would need to be undertaken as part of the licence assessment to ascertain whether the granting of the licence would be detrimental to the populations at FCS in their natural range (FCS test).

This species is also listed on Annex II of the Habitats Directive, and Special Areas of Conservation have been designated for the protection of areas recognised as distinct in providing features essential for life and reproduction. For activities likely to have a significant effect on the site, in addition to undertaking a risk assessment in relation to whether or not a disturbance/injury offence is likely to occur, developers will also need to consider the information necessary to allow an assessment by the competent authority as specified by the Habitats Regulations of the implications for the site in view of that site's conservation objectives (Appropriate Assessment).

**Harbour porpoise, *Phocoena phocoena***

In the UK, this species occurs widely distributed mainly in continental shelf waters. Satellite telemetry work has revealed relatively long-distance movements of tagged animals, including one from Danish waters into UK waters east of the Shetland Isles, a distance of some 1000 km[74]. Large scale changes in distribution are also apparent for the North Sea, where the area of highest density of porpoises has shifted southwards in the last decade[75-79]. This is likely to be indicative of animal movement associated with changes in the distribution and availability of prey[79].

Harbour porpoise is the most abundant cetacean species in UK waters. The current abundance estimate (from SCANS II[3]) is of 328,200 individuals for UK and adjacent waters (shelf mainly). The waters of north-west Europe, may hold a number of harbour porpoise sub-populations (as supported by genetic studies), for example in the British part of the North Sea and Western Scotland, and in the Irish Sea/Celtic Seas[80-82]. The sum of the abundance estimates for SCANS II survey blocks encompassing these areas was a total of 232,299 individuals for the North Sea, adjacent areas and Western Scotland, and 95,843 individuals for Irish Sea / Celtic Sea.

Most harbour porpoise schools are small, consisting of less than 8 individuals, however, they do, at times, form large, loose aggregations of 50 to several hundred animals, mostly for feeding or migration[83]. In the North Sea and adjacent waters, mean school size estimates were between 1.13 and 1.65 animals[75; 84].

Seasonal movements in UK waters are difficult to infer from the existing rather patchy monthly survey effort, but there are clear peaks in certain areas[76]. Some degree of spatial fidelity of individuals animals has been suggested by genetic studies for harbour porpoises, particularly females[81], and anecdotal observation of recognisable individuals[85].

Due to their large wide-spread populations, with individuals that may range over very large distances, it less likely that small-scale activities would cause disturbance under the Regulations. Conversely, certain larger scale activities with the potential for disturbance (e.g. displacement), could be licensable as a last resort, even if these activities had the potential to injure or disturb a few hundreds of individuals, as long as this was not considered to be detrimental to the populations at FCS in their natural range.

Recent studies with harbour porpoises suggest that this species might be sensitive to lower levels of noise than expected[6].

**White-beaked dolphin, *Lagenorhynchus albirostris***

This species occurs on the continental shelf around west and north Scotland and in the northern North Sea [68; 86; 87]. This species is found mostly in depths between 50 m and 100 m, and rarely over waters as deep as 200 m[86]. They are much less common in the southern North Sea, the English Channel and Irish Sea, and rarely recorded in deep waters offshore in contrast to its congener, the white-sided dolphin[86]. Although present year-round over the continental shelf in near-shore UK waters, the species has been observed most frequently between June and October[86].

The UK waters may hold a significant proportion of the total population of the north-east Atlantic, and it is possible that there is a discrete population in the North Sea and around north-west Britain[86]. Current estimated abundance in UK and adjacent waters (shelf only) is 22,400 individuals. The highest densities in the SCANS II survey (summer of 2005) occurred in the waters of western Scotland (0.32 animals/km$^2$, coefficient of variation (CV) = 0.91). White-beaked dolphins are usually found in schools numbering less than 10 individuals, but schools of up to 50 are not uncommon, and aggregations can comprise 100-500 animals in northern parts of their range and also in the North Sea[68].

**Short-beaked common dolphin, *Delphinus delphis***

In the north-east Atlantic this species is the most numerous offshore cetacean species[68; 76; 87]. It is mainly distributed off the western coasts of Britain and Ireland, both in continental shelf waters and beyond the continental shelf edge [68; 76; 87]. The species occurs notably in the Celtic Sea and western approaches to the English Channel and off southern and western Ireland. Small numbers are also found close inshore in the Sea of the Hebrides. This species has been observed occasionally in the northern North Sea, mainly in summer months, and sightings in this area have increased in the last 10 years.

There are no known local populations in UK waters, and those animals occurring in UK waters are part of a wider north-east Atlantic population. SCANS II[3] covered all European Atlantic continental shelf waters in June/July 2005 and estimated total abundance in the area as 63,366 (CV=0.46). This species is also widely distributed offshore and the number of animals in the continental shelf area may vary substantially seasonally and from year to year. Preliminary results from the CODA survey in 2007[65] estimated the total abundance in the

survey area to be 162,266 [95% CI = 65,990-399,001]. The combined abundance estimate for SCANS II and CODA is 180,100 [95% CI = 107,000-304,000] (Hammond, *pers com*). The total abundance from the NASS-95 surveys was estimated to be 273,159 [95% CI = 153,392-435,104] for the Western Block of the Faroes survey[88].

Common dolphins are gregarious animals, with average school sizes observed in north-west European waters of between six and 20, though large schools of dozens or even hundreds have frequently been recorded[68].

**White-sided dolphin, *Lagenorhynchus acutus***

Around the British Isles, this species is most commonly seen along the shelf edge and the deeper waters beyond, especially in the north-west[76, 68; 87; 89; 90] but it is also seen in shelf waters around Scotland, in the North Sea and south-west Britain, mainly in summer[8]. In UK waters, the species tends to be most abundant in the Faroe Bank, Faroe-Shetland Channel and the Rockall Trough areas[87; 89; 90]. It is known to use only a portion of UK waters and this is highly variable both seasonally and inter-annually.

There is no reliable total population estimate for this species at present. The SCANS II survey[3] estimated a total abundance of 27,227 (CV=0.38) for *Lagenorhynchus* species in UK and adjacent waters (shelf only) in the summer of 2005. A previous estimate of 74,626 individuals (CV=0.72, corrected for g(0)[xviii]) was made for the Faroe-Shetland Channel and 21,371 individuals (CV=0.54, corrected for g(0)) for the area to the west of the Outer Hebrides[91]. Abundance estimates have been difficult to obtain due to difficulties in separating white-sided dolphin and white-beaked dolphin identification at long-range[84]. This species is very gregarious, with observed school sizes frequently numbering in the tens to hundreds, and sometimes up to 1,000, particularly offshore. Within large aggregations, clusters of 2-15 animals can often be distinguished[92].

**Striped dolphin, *Stenella coeruleoalba***

Occurs mainly offshore of the continental shelf off Spain, Portugal and France. Around the British Isles, it used to be an occasional visitor, recorded mainly in the southwest, but sightings in this area have increased in recent years[65; 76]. The abundance estimate obtained from the CODA surveys is 82,585 [95% CI = 29,548 – 230,819] animals.

In European waters, group sizes most commonly vary between 6 and 60, often in mixed schools with common dolphins[68].

**Risso's dolphin, *Grampus griseus***

Risso's dolphins are mainly distributed off the western and northern coasts of Britain and Ireland and along the continental shelf[68; 76], with a few records from waters immediately over the shelf break. Risso's dolphins are known to use only a portion of UK waters and this is highly variable both seasonally and inter-annually. There seem to be more sightings on the continental shelf between May and October[76]. Greatest numbers have been observed from western Scotland with the waters around the Hebrides forming an obvious concentration. There are other clusters of sightings in the Irish Sea, - in the St George's Channel, off north Wales and the Isle of Man, as well as off south-west Ireland.

[xviii] g(0) is a measure of the probability that all animals at zero distance from the survey line are detected, g(0) = 1 if all animals are detected.

As a comparatively uncommon species, there have been no attempts to estimate the abundance of Risso's dolphin over wide areas in the north-east Atlantic. Nevertheless, the animals occurring in UK waters are likely to be part of a population ranging in size from 500 animals to the low 1,000s, similar to population sizes in the north-west Atlantic. At least 142 individuals were identified over two summers in the north-western Minch off western Scotland, with 52 of these being re-sighted in both summers[93]. This species forms small to medium-sized schools, typically ranging from 2-50 animals. Usual school size in UK waters ranges from 6 to 12 animals. However, single individuals have been recorded, as well as temporary aggregations of several hundreds or even thousands in some regions of the world[94]. In coastal areas, where these animals are found in potentially small semi-resident populations, one should assume an increased potential for chronic disturbance if there are persistent sources of noise in the area. Persistent sources of noise in areas where these populations occur therefore have the potential to cause disturbance under the Regulations. When that risk cannot be avoided or reduced to negligible levels, then a licence would be required for the noise producing activity to go ahead. Given the significance of even one animal for these small populations, a highly detailed assessment would need to be undertaken as part of the licence assessment to ascertain whether the granting of the licence would be detrimental to the populations at FCS in their natural range.

**Killer whale, *Orcinus orca***

Killer whales are known to use only a portion of UK waters and this is highly variable both seasonally and inter-annually[76]. Around the British Isles, the main area of distribution is the north and west, and killer whales are found along the shelf edge, especially north of Shetland, in inshore waters around the Northern and Western Isles and in the northern North Sea[68; 76]. The waters to the north and west of the UK, as well as the area of North Sea between Shetland and Norway, are likely to be important feeding grounds[76; 95; 96]. Sighting rates in coastal waters are higher in summer[76], and the seasonal pattern of sightings around Shetland may reflect feeding movements between inshore waters (summer) and offshore waters (winter)[97]. They are occasionally seen in the south-west, but generally absent from the southern North Sea, Irish Sea and English Channel[76]. There are a few records from deep water further offshore[87; 89].

The killer whales occurring in UK waters are likely to be part of a wider north Atlantic population; but their precise relationship is not known, and nor is the population size. A study of genotypic and phenotypic variation in killer whales throughout the north-east Atlantic is currently underway using photo-id and genetic data[98]. This will clarify if aggregations are distinct stocks or part of a large spatially dispersed single population.

The most recent sighting surveys in the eastern North Atlantic (mainly from Iceland to the Faroes) indicate a population of between 3500 and 12500 individuals[99], while around 3100 individuals were estimated for the Norwegian and Barents Seas[100], including Norwegian coastal waters. Most sightings in UK waters are of singles or pods of less than eight individuals (mean = 4.6), although aggregations of up to one hundred have been observed[90; 101]. In some coastal parts of the world, killer whales form stable pods and reside for periods of time in certain core areas where they return each year to socialise and to feed on migrating salmon[102]. Individual killer whales have been documented to move over very large areas, with ranges up to tens of thousands of $km^2$ for animals from both resident and transient populations[103].

**Long-finned pilot whale, *Globicephala melas***

Long-finned pilot whales in UK waters occur mainly off the continental shelf, but their numbers and distribution seems to be highly variable both between seasons and inter-annually. This species comes closer to the shore seasonally, mainly in winter, notably in the southwest approaches, western Channel, the northern North Sea and the Moray Firth. Greatest numbers have been observed to the north of Scotland and south-east of the Faroes, as well as along the shelf edge from southern Ireland south to the Bay of Biscay[76].

There is no recent population estimate for this species. Due to the difficulties of estimating parameters such as school size from ship-based surveys, a robust estimate of the total north Atlantic population cannot be made. The best estimate published is of 778,000 (CV = 0.30) individuals from a survey undertaken in 1989 which covered most of the northern and north-east Atlantic range[104]. Preliminary results from the CODA survey in 2007[65] estimated the total abundance in the survey area to be 83,441 [95% CI = 33,875-205,528]. Genetic studies have indicated that there is very little variability in mitochondrial DNA in pilot whales throughout the North Atlantic, and no significant differences between those sampled from the western North Atlantic, Iceland and the eastern North Atlantic[105]. This species mostly occurs in large pods. Mean pod size recorded on sighting surveys in the north-east Atlantic was 20[106]. During surveys off north and west Scotland, mean school size was found to be 11.5 (maximum 400)[90].

Individual pilot whales may move over very large areas. A juvenile animal fitted with a satellite-monitored radio tag in the Gulf of Maine was tracked for at least 3,144 km over three months[107].

**Sperm whale, *Physeter macrocephalus***

Sperm whales occur to the north and west of the British Isles and Ireland, mainly in waters deeper than 500m[68; 87; 89] although occasionally they may come onto the shelf, particularly in winter[108]. Sperm whales have been recorded in UK waters off the continental shelf in all months of the year, with a peak in mid summer[87; 89; 109]. Acoustic surveys carried out in spring and autumn over a period of 5 years detected higher densities in spring in the Faroe-Shetland Channel, while no apparent differences were noted in the Rockall Trough[110].

Sperm whales occurring in UK waters are likely to be part of a wider North Atlantic population[111] whose total current size is unknown. Abundance estimates exist for selected regions, mostly based on surveys carried out in the summer. For the north-east Atlantic, the estimates[99 112]corrected for animals missed on the trackline[113], gave an abundance of 6013 (CV=0.32) individuals for an area north of Norway and Iceland and 1772 (CV=0.18) for a larger area around Iceland and the Faroes. Preliminary results from the CODA survey in 2007[65] estimated the total abundance in the survey area to be 2,424 [95% CI = 1,250-4,700]. Only males (both mature and sub-adult) are normally found in UK waters, as females rarely occur in cooler temperate or subpolar latitudes[114; 115]. Male sperm whales are likely to occur in aggregations that may number tens of animals, although they will usually be spread over a large area.

Sperm whales undertake large-scale latitudinal and longitudinal migrations; some individuals (particularly males) can range over thousands of kilometres in one year.

**Minke whale, *Balaenoptera acutorostrata***

Minke whales occur mainly off the western coasts of Britain and Ireland in continental shelf waters, and throughout the north-western and central North Sea[68; 79; 86]. They also occur beyond the continental shelf edge. Sightings in coastal areas occur mainly in the summer[76] although the numbers using particular areas may vary considerably between seasons and years.

A total abundance of 16,400 individuals was estimated for UK and adjacent waters (shelf only)[3], and preliminary results from the CODA survey in 2007[65] estimated a total abundance in the survey area to be 6,765 [95% CI=1,239-36,925]. Four differentiated subpopulations of *B. acutorostrata* in the north Atlantic (west Greenland, central north Atlantic-east Greenland-Jan Mayen area, NE Atlantic, and North Sea) have been identified through genetic, diet and contaminant studies[116; 117]. Minke whales in UK waters are therefore likely part of a single northeast Atlantic/North Sea population, and no subpopulations have been identified so far. For example, there does not seem to be any structuring between minke whales off the east and the west coast of Scotland (Pia Anderwald, pers comm.). Minke whales are usually seen singly or in pairs although, when feeding, they sometimes form larger aggregations that can number 10-15 individuals[68].

**Fin whale, *Balaenoptera physalus***

The fin whale is the most abundant large baleen whale species in the North Atlantic. Around the UK, fin whales are mostly seen in deep waters beyond the edge of the continental shelf and during the summer and autumn[68; 87]. However, there are also all year-round records from shelf waters southwest of Britain, including juveniles[76]. Acoustic data show that fin whales are present throughout the year in UK waters[109].

The best available estimates of recent abundance accepted by the IWC Scientific Committee[118] are 25,800 (CV= 0.13) in 2001 for the central North Atlantic (East Greenland-Iceland, Jan Mayen, Faeroes and some waters within the UK 200 nm limit); 4,100 (CV 0.21) in 1996-2001 for the northeastern North Atlantic (North and West Norway); and 17,355 (CV 0.27) in 1989 for the Spain-Portugal-British Isles area[119]. Preliminary results from the CODA survey in 2007[65] estimated the total abundance in the survey area to be 7,523 [95% CI=4,945-11,444].

The relationship between whales that occur in UK waters and in the wider North Atlantic is unclear at the moment. Based mainly on past whaling operations, the IWC recognizes seven management areas in the North Atlantic, considering British Isles-Spain-Portugal as one of these. Based on genetic evidence however, it is now considered more likely that there are from two to four breeding stocks, which utilize these seven management areas in different proportions[118]. A comparatively non-social species, most sightings of fin whales are of single animals or pairs. However, it is likely that the one or two animals are part of a larger aggregation, which in some parts of its range can number hundreds of individuals spread over a wide area.

*Less common species in UK waters*

**Beaked whales**

Three species of beaked whale have been sighted in UK waters: northern bottlenose whale (*Hyperoodon ampullatus*), Sowerby's beaked whale (*Mesoplodon bidens*) and Cuvier's beaked whale (*Ziphius cavirostris*), and at least three further species of beaked whale can also be expected to occur, albeit very rarely.

Around the UK, northern bottlenose whales are recorded mostly beyond the shelf edge to the north-west of Scotland and in the northern Bay of Biscay[76; 87; 89]. This species is thought to migrate north in spring, returning south in autumn, and most sightings in UK waters have been during the summer months. However, in Faroese waters, where peak sightings and catches also occur in late summer, the species is known to be present throughout the year[76]. Northern bottlenose abundance was estimated as 27,900 animals (CV=0.67, 1995) and 28,000 (CV=0.22, 2001) (uncorrected, negatively biased) from ship surveys around Iceland and Faroes in the summer[120]. However, neither survey covered the entire summer range of the species, which extends farther south of Iceland and the Faroes at this time of year. The average school size of bottlenose whales sighted in the Atlantic Frontier area was 2.4 animals[87].

Preliminary results from the CODA survey in 2007[65] estimated the total abundance of beaked whales (Cuvier's, Sowerby's and northern bottlenose whales) in the survey area (see Figure 2) to be 9,771 (CV=0.44). In the western Atlantic several estimates have been made for Mesoplodon spp. Grouped, and Cuvier's beaked whale and these have all been in the low hundreds. However, due to the cryptic nature of these species (deep diving and occurring in small groups) these estimates carry a substantial negative bias. Sowerby's beaked whale is the commonest Mesoplodon species in the north-east Atlantic, being the most frequently seen and stranded. There have only been a few confirmed sightings in UK waters, all in western areas, but it seems probable that most sightings of unidentified mesoplodonts were of this species. These records are mostly from deep water just beyond the shelf edge, to the north-west of Scotland[68; 89]. The average school size of *Mesoplodon* spp. in the Atlantic Frontier was 2.3 animals[87]. Cuvier's beaked whale, is frequently recorded in the Bay of Biscay and further south, and there have been a few confirmed sightings in UK waters (off west Scotland and in the northern North Sea), all in the summer[68; 76].

Although site fidelity has been reported for several species of beaked whales in some parts of the world[121-123], this has not yet been shown in UK waters. The number of beaked whales using particular areas in UK waters may vary considerably between seasons and years, but some species might be present in waters off the continental shelf throughout the year.

Certain beaked whale species seem particularly sensitive to non-pulsed sound, with several mass strandings associated with sound levels lower than those that would normally cause auditory injury to other species.

**Other baleen whales**

All of the following species of baleen whales are highly migratory, generally feeding at high latitudes in the summer and moving to lower latitudes to breed in the warmer waters in the winter. All are comparatively non-social species, with most sightings being of single animals

or pairs. However, it is possible that the one or two individuals are part of larger aggregations, which in some parts of their range can number hundreds of individuals spread over a wide area.

Humpback whales *Megaptera novaeangliae* occur in deep waters beyond the continental shelf to the west of Britain, this region probably forming part of their migration route. Sightings of the species usually come from waters deeper than 200m to the north and west of Scotland[76], but this species can also occur near the coast[90]. Humpback whales are regularly recorded by acoustic monitoring between November and March, mostly from north of Scotland to west of Ireland, and less frequently to the southwest of the British Isles[109]. In the summer, a very small number of humpbacks are found in British shelf waters, particularly around the Northern Isles and also in western areas from the Hebrides to the English Channel[76]. Recent estimates include 13,900 individuals for Iceland (CI=3,900 – 29,000) and 889 for N Norway/Spitzbergen (CV=0.32)[124; 125]. Six distinct feeding aggregations have been identified: Gulf of Maine; Gulf of St Lawrence; Newfoundland/Labrador; West Greenland; Iceland; and North Norway; and genetic and photo-ID data indicate that these represent relatively discrete subpopulations. However, whales from different feeding grounds all mix in a common breeding area in the West Indies. The global population is estimated to be increasing rapidly (3% per year), and the Iceland population may be increasing even more rapidly (surveys showed an increase of 11.4% per annum from 1986 to 2001, although immigration as well as population growth may be responsible for this)[125].

Sei whales *Balaenoptera borealis* tend to be found further offshore than fin whales, in water depths of 500m to 3000m[76]. Their migration route is thought to pass along the edge of the continental shelf to the west of Britain and Ireland[126]. In UK waters, this species is most frequently recorded in the Faroe-Shetland Channel and adjacent waters, and also occasionally in deep waters west of Scotland, but only rarely in the shelf waters of western Britain. No current population estimates exist for sei whales in the north Atlantic, although sighting surveys undertaken in the late 1987 and 1989 indicated a possible abundance of 13,500 individuals[119]. Preliminary results from the CODA survey in 2007[65] estimated the total abundance in the survey area to be 360 [95% CI=174 – 744]. Sei whales are mainly observed north and west of Scotland between May and October, although sightings have also been made in the south western approaches, between Ireland and south west England[90]. Whaling records from the early 20$^{th}$ century show a similar seasonal pattern, with most catches made along the shelf edge from June to August. All data sources indicate that there are high inter-year variations in the occurrence of this species.

In the north-east Atlantic, the distribution of the blue whale, *Balaenoptera musculus*, appears to be centred on Iceland. This species is a rare visitor to UK waters, most recently being recorded in deep waters in the Faroe-Shetland Channel and the Rockall Trough[76; 109; 127]. Abundance around Iceland was estimated at around 400 individuals[128]. Acoustic monitoring to the west of the British Isles continental shelf has indicated a peak occurrence of blue whales during November and December[109].

**Uncommon and vagrant species**

The following species are uncommon or vagrant in this region – the northern right whale, the false killer whale, the pigmy sperm whale, Fraser's dolphins, the beluga whale, the narwhal, and the melon-headed whale. It is therefore highly unlikely that any activity in UK waters would cause injury or disturbance to these species.

## *4.2. Turtles*

Five species of marine turtle are listed in Schedule 2 of the HR and Schedule 1 of the OMR (EPS). The leatherback turtle *Dermochelys coriacea* is the only species considered to be a regular visitor to UK waters, albeit a rare one. Leatherback turtle records make up over 90% of all identified turtle sighting and stranding records (33 leatherback turtles on average, and between 15 and 62 per year); and it is the only species that exhibits physiological adaptations to allow it to function in temperate waters, such as those around the UK. Leatherbacks feed exclusively on jellyfish and other gelatinous zooplankton that form ephemeral aggregations in space and time[129].[130] They do not simply migrate between their tropical nesting site and a single foraging area, but consistently cruise the oceans in search of new foraging opportunities also exploring the northern latitude waters which offer a rich jellyfish habitat and thus they occasionally enter UK waters.

Given the apparent low density of leatherbacks within UK waters and their highly migratory nature, the likelihood of occurrence in any area for any lengthy period of time is so low that the risk of animals being disturbed in a way that would impair their ability to survive, reproduce, migrate, rear or nurture their young could be considered negligible. Due to their occurrence in very low numbers in any given area it is also unlikely that there could be a significant effect on their local abundance or distribution as a result of an activity. However, there might be a risk of injury as a result of some activities and this should be assessed and mitigated for as necessary.

Marine turtles are also prone to bycatch on fishing gear; however, this is not covered in the current guidance since sea fishing in Member States waters is regulated within the framework of the Common Fisheries Policy. Fishermen who are fishing in accordance with the by-catch measures in the Common Fisheries Policy are unlikely to commit an offence under these Regulations. Clearly, however, if fishermen were found to be deliberately capturing, killing, injuring or disturbing protected species then they would be liable for prosecution.

## *4.3.* Sturgeon*, Acipenser sturio*

The European sturgeon migrates along the Atlantic coast of Europe from the Bay of Biscay to the Bristol Channel and the North Sea. However, because of the small size of the population, *A. sturio* is now a rare visitor to Northern European waters. The last known areas for European sturgeon reproduction are in France; in the Garonne and Dordogne rivers.

It is unlikely that any activity in the UK would cause injury or disturbance to this species. Factors that could potentially cause disturbance include habitat degradation (particularly spawning grounds and nursery areas) and physical obstacles to migration. Since the sturgeon is not currently known to breed in UK waters, this is highly unlikely to occur in practice. Given the size and connectivity of the marine environment compared to terrestrial habitats, and the very low density of *A. sturio* in UK waters, it is very unlikely that animals could be disturbed in a way that would impair their ability to survive, reproduce, migrate, rear or nurture their young, or that their local abundance or distribution could be significantly affected. If this species starts to breed in UK waters or increase in abundance, the likelihood of an offence will need to be re-assessed.

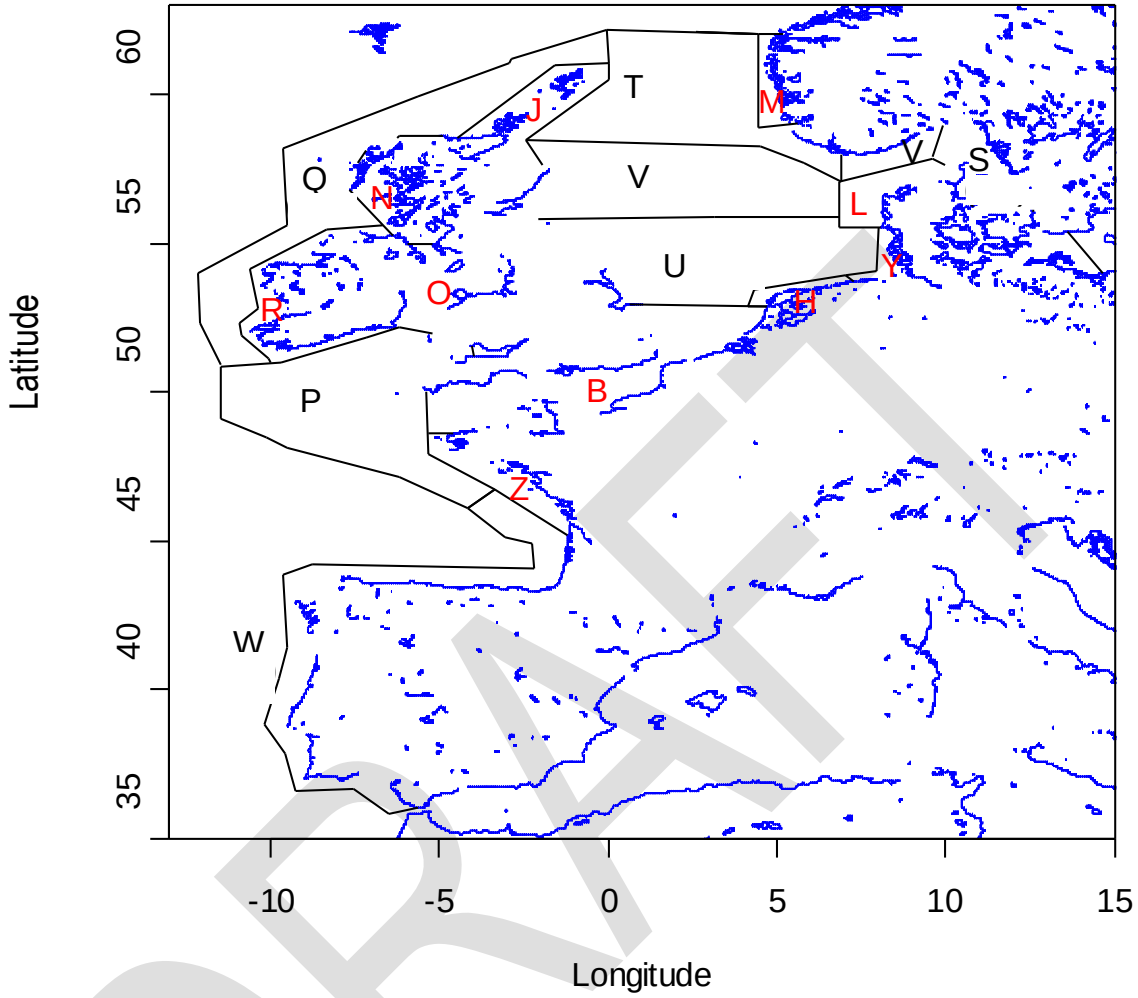



Figure 1. SCANS II[3] survey blocks.

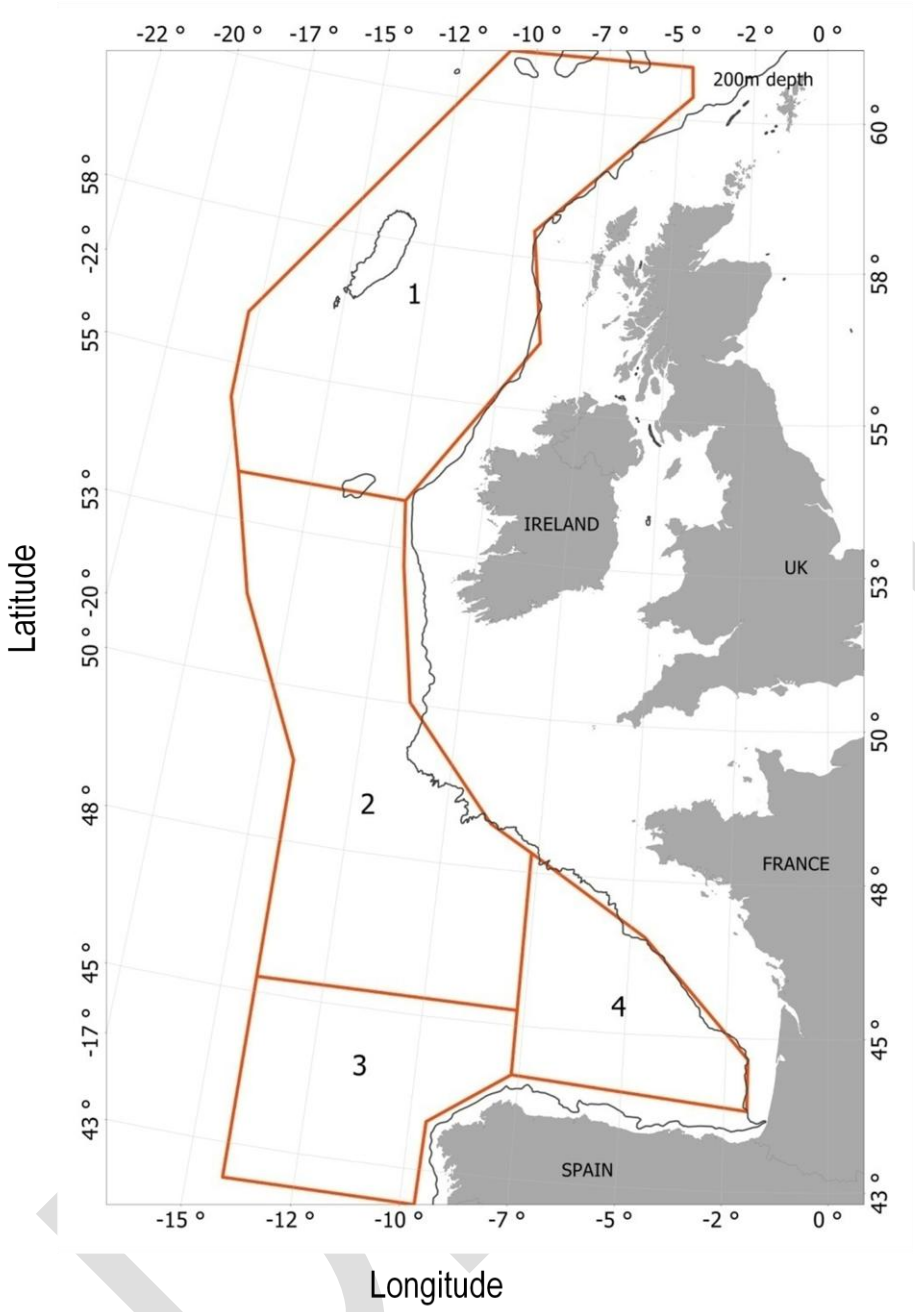



Figure 2. CODA[65] survey blocks.

Table 2. Animal abundance and density (animals/km$^2$) estimates from the SCANS II[3] shipboard and aerial surveys per block (see Figure 1 to locate blocks). Figures in parentheses are Coefficients of Variation (CVs).

| Species | Shipboard surveys | | | Aerial surveys | | |
|---|---|---|---|---|---|---|
| | Block | Animal abundance | Animal density | Block | Animal abundance | Animal density |
| HP | V | 47 131 (0.37) | 0.294 (0.37) | B | 40 927 (0.38) | 0.331 (0.38) |
| | Q | 10 002 (1.24) | 0.067 (1.24) | J | 10 254 (0.36) | 0.274 (0.36) |
| | U | 88 143 (0.23) | 0.562 (0.23) | N | 12 076 (0.43) | 0.394 (0.43) |
| | T | 23 766 (0.33) | 0.177 (0.33) | O | 15 230 (0.35) | 0.335 (0.35) |
| | P | 80 613 (0.50) | 0.408 (0.50) | | | |
| MW | V | 4 449 (0.45) | 0.028 (0.45) | B | 1 202 (0.96) | 0.0097 (0.96) |
| | Q | 1 856 (0.46) | 0.012 (0.46) | J | 835 (1.02) | 0.0223 (1.02) |
| | U | 3 519 (0.69) | 0.022 (0.69) | O | 1 073 (0.89) | 0.0236 (0.89) |
| | T | 1 738 (0.52) | 0.013 (0.52) | | | |
| | P | 1 719 (0.43) | 0.009 (0.43) | | | |
| WB | V | 7 862 (0.37) | 0.049 (0.37) | J | 682 (0.86) | 0.0182 (0.86) |
| | Q | 2 030 (0.60) | 0.014 (0.60) | N | 9 731 (0.91) | 0.3177 (0.91) |
| | U | 493 (0.48) | 0.003 (0.48) | O | 75 (0.80) | 0.0016 (0.80) |
| | T | 1 525 (0.56) | 0.011 (0.56) | | | |
| BD | V | 123 (4.83) | 0.001 (4.83) | B | 395 (0.74) | 0.0032 (0.74) |
| | Q | 1 128 (0.68) | 0.008 (0.68) | J | 412 (0.86) | 0.0110 (0.87) |
| | T | 117 (0.79) | 0.001 (0.79) | N | 246 (1.04) | 0.0080 (1.05) |
| | P | 5 370 (0.49) | 0.027 (0.49) | O | 235 (0.75) | 0.0052 (0.75) |
| CD | Q | 1 454 (0.81) | 0.010 (0.81) | B | 14 349 (1.66) | 0.1159 (1.66) |
| | P | 11 141 (0.61) | 0.056 (0.61) | N | 2 322 (0.61) | 0.0758 (0.61) |
| | | | | O | 366 (0.73) | 0.0081 (0.73) |
| *Lag* sp. | V | 6 460 (0.35) | 0.040 (0.35) | | | |
| | Q | 7 736 (0.29) | 0.052 (0.29) | | | |
| | U | 405 (1.00) | 0.003 (1.00) | | | |
| | T | 12 627 (0.80) | 0.094 (0.80) | | | |

HP: harbour porpoise; MW: minke whale; WB: white-beaked dolphin; BD: bottlenose dolphin; CD: common dolphin; *Lag* sp.: refers to white-beaked dolphin and white-sided dolphin combined due to difficulty in distinguishing the two species in the field.

Table 3. Preliminary estimates of animal abundance and animal density (animals/km$^2$) from the CODA[65] survey. Figures in parentheses are CVs. See Figure 2 to locate blocks.

| Species | Block | Animal abundance | Animal density (animals/km$^2$) |
|---|---|---|---|
| **CD** | 1 | 3,911 (0.59) | 0.01 (0.59) |
| | 2 | 114,622 (0.59) | 0.34 (0.59) |
| **SD** | 1 | 1,770 (1.12) | 0.005 (1.12) |
| | 2 | 54,775 (0.76) | 0.16 (0.76) |
| **CD, SD & CS** | 1 | 5,682 (0.55) | 0.02 (0.55) |
| | 2 | 189,357 (0.52) | 0.56 (0.52) |
| **LF** | 1 | 60,007 (0.58) | 0.172 (0.58) |
| | 2 | 18,866 (0.66) | 0.056 (0.66) |
| **PW** | 1 | 64 945 (0.55) | 0.186 (0.55) |
| | 2 | 16 906 (0.61) | 0.050 (0.61) |
| **FW** | 1 | 241 (0.45) | 0.001 (0.45) |
| | 2 | 3,635 (0.33) | 0.01 (0.34) |
| **LB** | 1 | 241 (0.45) | 0.001 (0.45) |
| | 2 | 3,802 (0.33) | 0.01 (0.33) |
| **SP** | 1 | 421 (0.46) | 0.001 (0.46) |
| | 2 | 879 (0.52) | 0.003 (0.52) |

CD: Common dolphins; SD: Striped dolphins; CS: Common or Striped dolphin; LF: Long finned pilot whale; PW: Pilot whale (long & short finned); FW: Fin whale; FS: Fin or Sei whale; SW: Sei whale; LB: Large baleen whale; SP: Sperm whale.

Table 4. Conventional line transect preliminary abundance estimates from the CODA[65] survey. Figures in parentheses are CVs. See Figure 2 to locate blocks.

| Species | Block | Animal abundance | Animal density (animals/km$^2$) |
|---|---|---|---|
| **BD** | 1 | 5,709 (0.35) | 0.02 (0.35) |
| | 2 | 11,536 (0.33) | 0.03 (0.33) |
| **MW** | 1 | 5,547 (1.03) | 0.016 (1.03) |
| | 2 | 1,218 (1.04) | 0.004 (1.04) |
| **BW** | 1 | 5,760 (0.60) | 0.02 (0.60) |
| | 2 | 1,490 (0.56) | 0.004 (0.56) |

BD: Bottlenose dolphins; MW: Minke whale; BW: Beaked whale

## REFERENCES


1. Read, A. J., Drinker, P. and Northridge, S. P. 2006 Bycatch of marine mammals in US and global fisheries. *Conservation Biology*, **20**, pp. 163-169.

2. EUROPEAN COMMISSION 2007 Guidance document on the strict protection of animal species of community interest under the Habitats Directive 92/43/EEC.

3. SCANS-II 2008 *Small Cetaceans in the European Atlantic and North Sea*. Available from SMRU, Gatty Marine Laboratory, University of St Andrews, St Andrews, Fife, KY16 8LB, UK. Final Report submitted to the European Commission under project LIFE04NAT/GB/000245.

4. Wilson, B., Reid, R. J., Grellier, K., Thompson, P. M. and Hammond, P. S. 2004 Considering the temporal when managing the spatial: a population range expansion impacts protected areas-based management for bottlenose dolphins. *Animal Conservation*, **7**, pp. 331-338.

5. Southall, B. L., BOWLES, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Greene, C. R., Kastak, D., Ketten, D., Miller, J. H., Nachtigal, P. E., Richardson, W. J., Thomas, J. A. and Tyack, P. 2007 Marine mammal noise exposure criteria: initial scientific recommendations. *Aquatic Mammals*, **33**, pp. 411-521.

6. Lucke, K., Lepper, P. A., Blanchet, M.-A. and Siebert, U. Testing the auditory tolerance of harbour porpoise hearing for impulsive sounds. Effects of Noise on Marine Life Conference, edition, Nyborg, Denmark.

7. Carstensen, J., Henriksen, O. D. and Teilmann, J. 2006 Impacts of offshore wind farm construction on harbour porpoises: acoustic monitoring of echolocation activity using porpoise detectors (T-PODs). *Marine Ecology-Progress Series*, **321**, pp. 295-308.

8. Tougaard, J., Carstensen, J., Henriksen, O. D., SKOV, H. S., & Teilmann, J. 2003 *Short-term effects of the construction of wind turbines on harbour porpoises at Horns Reef.* Technical report to Techwise A/S, HME/362-02662. Hedeselskabet, Roskilde. Also available at: www.hornsrev.dk.

9. Tougaard, J., Carstensen, J., Teilmann, J., & Bech, N. I. 2005 *Effects of the Nysted Offshore wind farm on harbour porpoises.* Technical Report to Energi E2 A/S. NERI, Roskilde (Also available at http://uk.nystedhavmoellepark.dk).

10. Morton, A. B. and Symonds, H. K. 2002 Displacement of Orcinus orca (L.) by high amplitude sound in British Columbia, Canada. *Ices Journal of Marine Science*, **59**, pp. 71-80.

11. Johnston, D. W. 2002 The effect of acoustic harassment devices on harbour porpoises (Phocoena phocoena) in the Bay of Fundy, Canada. *Biological Conservation*, **108**, pp. 113-118.

12. Tougaard, J. & Teilmann, J. 2007 *Rødsand 2 Offshore Windfarm. Environmental Impact Assessment - Marine Mammals.* Commissioned Report to DONG Energy. National Environmental Research Institute. 77 pp..

13. Harwood, J. 2001 Marine mammals and their environment in the twenty-first century. *Journal of Mammalogy*, **82**, pp. 630-640.

14. Richardson, W. J., Finley, K. J., Miller, G. W., DAVIS, R. A. and Koski, W. R. 1995 Feeding, social and migration behaviour of bowhead whales, *Balaena mysticetus*, in Baffin Bay vs. the Beaufort Sea - regions with different amounts of human activity. *Marine Mammal Science*, **11**, pp. 1-45.

15. Evans, P. G. H. & Wang, J. 2003 *Re-examination of distribution data for the harbour porpoise around Wales and the UK with a view to site selection for this species*. Report to Countryside Council for Wales.Sea Watch Foundation, Oxford.115pp.

16. NRC 2005 *Marine Mammal Populations and Ocean Noise: Determining when noise causes biologically significant effects*. National Academies Press, Washington, D.C.

17. Miller, S., Han, F., Prado, J. and Busbee, D. 2000 Estrogen receptors in dolphin kidney endothelial cells: Detection and comparison with estrogen receptors from MCF-7 cells. *In Vitro & Molecular Toxicology-A Journal of Basic and Applied Research*, **13**, pp. 199-211.

18. Nowacek, S. M., Wells, R. S. and Solow, A. R. 2001 Short-term effects of boat traffic on bottlenose dolphins, Tursiops truncatus, in Sarasota Bay, Florida. *Marine Mammal Science*, **17**, pp. 673-688.

19. Constantine, R., Brunton, D. H. and Dennis, T. 2004 Dolphin-watching tour boats change bottlenose dolphin (Tursiops truncatus) behaviour. *Biological Conservation*, **117**, pp. 299-307.

20. Stone, C. J. and Tasker, M. L. 2006 The effects of seismic airguns on cetaceans in UK waters. *Journal of Cetacean Research and Management*, **8**, pp. 255-264.

21. Jepson, P. D., Arbelo, M., Deaville, R., Patterson, I. A. P., Castro, P., Baker, J. R., Degollada, E., Ross, H. M., Herraez, P., Pocknell, A. M., Rodriguez, F., Howiell, F. E., Reid, R. J., Jaber, J. R., Martin, V., Cunningham, A. A. and Fernández, A. 2003 Gas-bubble lesions in stranded animals: Was sonar responsible for a spate of whale deaths after an Atlantic military exercise? *Nature*, **425**, pp. 575-576.

22. Fernandez, A., Edwards, J. F., Rodriguez, F., Espinosa de los Monteros, A., Herraez, P., Castro, P., Jaber, J. R., Martin, V. and Arbelo, M. 2005 "Gas and fat embolic syndrome" involving a mass stranding of beaked whales (family Ziphiidae) exposed to anthropogenic sonar signals. *Veterinary Pathology* pp. 446-457.

23. Williams, R., Lusseau, D. and Hammond, P. S. 2006 Estimating relative energetic costs of human disturbance to killer whales (Orcinus orca). *Biological Conservation*, **133**, pp. 301-311.

24. Bejder, L., Samuels, A., Whitehead, H. and Gales, N. 2006 Interpreting short-term behavioural responses to disturbance within a longitudinal perspective. *Animal Behaviour*, **72**, pp. 1149-1158.

25. Bejder, L., Samuels, A., Whitehead, H., Gales, N., Mann, J., Connor, R., Heithaus, M., Watson-Capps, J., Flaherty, C. and Krutzen, M. 2006 Decline in relative abundance of bottlenose dolphins exposed to long-term disturbance. *Conservation Biology*, **20**, pp. 1791-1798.

26. Stolen, M. K. and Barlow, J. 2003 A model life table for bottlenose dolphins (Tursiops truncatus) from the Indian River Lagoon System, Florida, USA. *Marine Mammal Science*, **19**, pp. 630-649.

27. Olesiuk, P. F., BIGG, M. A., & Ellis, G. M. 1990 *Life history and population dynamics of resident killer whales (Orcinus orca) in the coastal waters of British Columbia and Washington State*. Report of the International Whaling Commission (Special issue 12).

28. Slooten, E. and Lad, F. 1991 Population biology and conservation of Hector's dolphin. *Canadian Journal of Zoology-Revue Canadienne de Zoologie*, **69**, pp. 1701-1707.

29. Wade, P., Watters, G. M., Gerrodette, T. and REILLY, S. B. 2007 Depletion of spotted and spinner dolphins in the eastern tropical Pacific: modeling hypotheses for their lack of recovery. *Marine Ecology-Progress Series*, **343**, pp. 1-14.

30. Woodley, T. H. and Read, A. J. 1991 Potential rates of increase of a harbor porpoise (phocoena-phocoena) population subjected to incidental mortality in commercial fisheries. *Canadian Journal of Fisheries and Aquatic Sciences*, **48**, pp. 2429-2435.

31. Wade, P. R. 1998 Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. *Marine Mammal Science*, **14(1)**, pp. 1-37.

32. Nowacek, D. P., Thorne, L. H., Johnston, D. W. and Tyack, P. 2007 Responses of cetaceans to anthropogenic noise. *Mammal Review*, **37**, pp. 81-115.

33. Gordon, J. C. D., Thompson, D., Gillespie, D., Lonergan, M., Calderan, S., Jaffey, B., & Todd, V. 2007 *Assessment of the potential for acoustic deterrents to mitigate the impact on marine mammals of underwater noise arising from the construction of offshore widfarms*. COWRIE DETER-01-20007.

34. Olesiuk, P. F., Nichol, L. M., Sowden, M. J. and Ford, J. K. B. 2002 Effect of the sound generated by an acoustic harassment device on the relative abundance and distribution of harbor porpoises (Phocoena phocoena) in retreat passage, British Columbia. *Marine Mammal Science*, **18**, pp. 843-862.

35. Nowacek, D. P., Johnson, M. P. and Tyack, P. L. 2007 North Atlantic right whales (*Eubalaena glacialis*) ignore ships but respond to alerting stimuli. *Proceedings of the Royal Society of London Series B-Biological Sciences*, **271**, pp. 227-231.

36. Highley, D. E., Hetherington, L. E., Brown, T. J., Harrison, D. J., & Jenkins, G. O. 2007 *The strategic importance of the marine aggregate industry to the UK*. British Geological Survey Research Report, OR/07/019.

37. Posford Duvivier Environment & HILL, M. I. 2001 *Guidelines on the impact of aggregate extraction on European Marine Sites*. Countryside Council for Wales (UK Marine SACs Project).

38. Richardson, W. J., Greene, C. R., Malme, C. I. and Thomson, D. H. 1995 *Marine mammals and noise*. Academic Press, San Diego, California.

39. Patenaude, N. J., Richardson, W. J., Smultea, M. A., Koski, W. R., Miller, G. W., Wursig, B. and Greene, C. R. 2002 Aircraft sound and disturbance to bowhead and beluga whales during spring migration in the Alaskan Beaufort Sea. *Marine Mammal Science*, **18**, pp. 309-335.

40. SMRU Ltd 2007 *Assessment of the potential for acoustic deterrents to mitigate the impact on marine mammals of underwater noise arising from the construction of offshore windfarms.* Commissioned by COWRIE Ltd (project reference DETER-01-07).

41. Nedwell, J. R., Parvin, S. J., Edwards, B., Workman, R., Brooker, A. G., & Kynoch, J. E. 2007 *Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters* . Subacoustech Report No. 544R0738 to COWRIE Ltd. ISBN: 978-0-9554279-5-4.

42. Shepherd, B., Weir, C. R., Golightly, C., Holt, T., & Gricks, N. 2006 *Underwater noise impact assessment on marine mammals and fish during pile driving of proposed round 2 offshore wind farms in the Thames Estuary for CORE Limited on behalf of London Array Limited, Greater Gabbard Offshore Winds Limited and Thanet Offshore Wind Limited*. Report No. EOR0523.

43. Evans, P. G. H. Offshore windfarms and marine mammals: impacts & methodologies for assessing impacts. Proceedings of Workshop held at the ECS 21stAnnual Conference, San Sebastian, Spain, April 2007 European Cetacean Society, Kiel, Germany. 68pp edition.

44. Madsen, P. T. and Mohl, B. 2000 Sperm whales (Physeter catodon L-1758) do not react to sounds from detonators. *Journal of the Acoustical Society of America*, **107**, pp. 668-671.

45. Evans, P. G. H. and Miller, L. A. Active Sonar and Cetaceans. Proceedings of Workshop held at the ECS 17th Annual Conference edition.

46. Frantzis, A. 1998 Does acoustic testing strand whales? *Nature*, **392**, p. 29.

47. Madsen, P. T., Wahlberg, M., Tougaard, J., Lucke, K. and Tyack, P. 2006 Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. *Marine Ecology-Progress Series*, **309**, pp. 279-295.

48. Gordon, J. G., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M., Swift, R. J. and Thompson, D. 2004 A review of the effects of seismic survey on marine mammals. *Marine Technology Society Journal*, **37**, pp. 14-34.

49. Weir, C. R. 2008 Overt responses of humpback whales, sperm whales and Atlantic spotted dolphins to seismic exploration off Angola. *Aquatic Mammals*, **34**.

50. Richardson, W. J., Wursig, B. and Greene, C. R. 1986 Reactions of bowhead whales, Balaena mysticetus, to seismic exploration in the Canadian Beaufort Sea. *Journal of the Acoustical Society of America*, **79**, pp. 1117-1128.

51. Goold, J. C. and Fish, P. J. 1998 Broadband spectra of seismic survey air-gun emissions, with reference to dolphin auditory thresholds. *Journal of the Acoustical Society of America*, **103**, pp. 2177-2184.

52. Madsen, P. T., Johnson, M., Miller, P. J. O., Soto, N. A., Lynch, J. and Tyack, P. 2006 Quantitative measures of air-gun pulses recorded on sperm whales (Physeter macrocephalus) using acoustic tags during controlled exposure experiments. *Journal of the Acoustical Society of America*, **120**, pp. 2366-2379.

53. Richardson, W. J. and Wursig, B. 1997 Influences of man-made noise and other human actions on cetacean behaviour. *Marine and Freshwater Behaviour and Physiology*, **29** , pp. 183-209.

54. SCAR 2005 Risks posed to the Antarctic marine environment by acoustic instruments: a structured analysis. *Antarctic Science*, **17**, pp. 533-540.

55. NRC 2003 *Ocean Noise and Marine Mammals*. National Academic Press, Washington, DC.

56. McDonald, M. A., Hildebrand, J. A. and Wiggins, S. M. 2006 Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California. *Journal of the Acoustical Society of America*, **120**, pp. 711-718.

57. Evans, P. G. H. Shipping as a possible source of disturbance to cetaceans in the ASCOBANS region. ASCOBANS 4th Meeting of the Parties, Esbjerg, Denmark, 19-22 August 2003. Document MOP4/Doc. 17(S). 85pp edition.

58. Lusseau, D., Slooten, E., Dawson, S. M., & Higham, J. 2002 *The effects of tourism activities on bottlenose dolphins (Tursiops spp.) in Fiordland: working towards a sustainable solution*. Wellington, New Zealand, Final report to the New Zealand Department of Conservation.

59. Lusseau, D. and Higham, J. E. S. 2004 Managing the impacts of dolphin-based tourism through the definition of critical habitats: the case of bottlenose dolphins (Tursiops spp.) in Doubtful Sound, New Zealand. *Tourism Management*, **25**, pp. 657-667.

60. Lusseau, D. 2003 Effects of tour boats on the behavior of bottlenose dolphins: Using Markov chains to model anthropogenic impacts. *Conservation Biology*, **17**, pp. 1785-1793.

61. Lusseau, D. 2004 The hidden cost of tourism: Detecting long-term effects of tourism using behavioral information. *Ecology and Society*, **9**.

62. Lusseau, D., Slooten, L. and Currey, R. J. C. 2007 Unsustainable dolphin-watching tourism in Fiordland, New Zealand. *Tourism in Marine Environments*, **3**.

63. Baird, R. W. 2001 Status of Killer Whales, Orcinus orca, in Canada. *Canadian Field-Naturalist*, **115**, pp. 676-701.

64. Evans, P. G. H. 2008 Cetacea. In *Mammals of the British Isles*.

65. Macleod, K., Burt, M. L., Canadas, A., Rogan, E., Santos, M. B., Uriarte, A., Van Canneyt, O., Vazquez, J. A., & Hammond, P. S. 2008 *Preliminary abundance estimates of cetaceans in offshore European Atlantic waters*. Report of the IWC Scientific Committee, SC/60/O2.

66. Quérouil, S., Silva, M. A., Freitas, L., Prieto, R., Magalhaes, S. M., Dinis, A., Alves, F., Matos, J. A., Mendonca, D., Hammond, P. S. and Santos, R. S. 2007 High gene flow in oceanic bottlenose dolphins (*Tursiops truncatus*) of the North Atlantic. *Conservation Genetics*.

67. Parsons, K. M., Noble, L. R., Reid, R. J. and Thompson, P. M. 2002 Mitochondrial genetic diversity and population structuring of UK bottlenose dolphins (Tursiops truncatus): is the NE Scotland population demographically and geographically isolated? *Biological Conservation*, **108**, pp. 175-182.

68. Reid, J. B., Evans, P. G. H. and Northridge, S. P. 2003 *Atlas of cetacean distribution in north-west European waters*. Peterborough.

69. Stockin, K. A., Weir, C. R. and Pierce, G. J. 2006 Examining the importance of Aberdeenshire (UK) coastal waters for North Sea bottlenose dolphins (Tursiops truncates). *Journal of the Marine Biological Association of the United Kingdom*, **86**, pp. 201-207.

70. Williams, A. D., Williams, R., Heimlich-Boran, J. R., Evans, P. G. H., Tregenza, N. J. C., Ridoux, V., Liret, C. and Savage, S. A preliminary report on an investigation into bottlenose dolphins (Tursiops truncatus) of the English Channel: A collective approach. European Research on Cetaceans edition, pp. 217-220.

71. Wood, C. 1998 Movements of bottlenose dolphins around south-west of Britain. *Journal of Zoology*, **246**, pp. 155-163.

72. Grellier, K. and Wilson, B. 2003 Bottlenose dolphins using the Sound of Barra, Scotland . *Aquatic Mammals*, **29**, pp. 378-382.

73. Wilson, B., Thompson, P. M. and Hammond, P. S. 1997 Habitat use by bottlenose dolphins: seasonal distribution and stratified movement patterns in the Moray Firth, Scotland. *Journal of Applied Ecology*, **34**, pp. 1365-1374.

74. Teilmann, J., Dietz, R., Larsen, F., Desportes, G., Geersten, B. M., Andersen, L. W., Aastrup, P., Hansen, J. R., & Buholzer, J. 2004 *Satellitsporing af marsvin i danske og tilstødende farvande. 3Fjord&Bælt.* Available at: http://www.dmu.dk/1_viden/_2_Publikationer/3_fagrapporter/rapporter/FR484.pdf.

75. Thomsen, F., Laczny, M. and Piper, W. 2006 A recovery of harbour porpoises (Phocoena phocoena) in the southern North Sea? A case study off Eastern Frisia, Germany. *Helgoland Marine Research*, **60**, pp. 189-195.

76. Evans, P. G. H., Anderwald, P., & Baines, M. E. 2003 *UK Cetacean Status Review* . Report to English Nature and the Countryside Council for Wales.

77. Haelters, J. & Jacques, T. G. 2006 *De bescherming van walvisachtigen in Belgische wateren: bijkomende informatie gericht aan DG Leefmilieu van de federale Overheidsdienst volksgezondheid, veiligheid van de voedselketen en leefmilieu, m.b.t. de uitvoering door België van de Habitatrichtlijn Art. 11 en 12 voor wat betreft walvisachtigen. . Koninklijk Belgisch Instituut voor Natuurwetenschappen,* Beheerseenheid Mathematisch Model Noordzee (BMM), Brussels.

78. Hassami, S. 2006 *Cetacean strandings along the French coast 2004. Document Paper prepared for ASCOBANS 13th Advisory Committee Meeting,Tampere,Finland,25 - 27 April 2006.*

79. Hammond, P. S. & Macleod, K. 2006 *SCANS II - Report on Progress. Paper prepared for ASCOBANS 5th Meeting of the Parties, Netherlands, September, 2006. MOP5/Doc. 26.*

80. Rosel, P. E., Tiedemann, R. and Walton, M. J. 1999 Genetic evidence for limited trans-Atlantic movements of the harbor porpoise Phocoena phocoena. *Marine Biology*, **133**, pp. 583-591.

81. Walton, M. J. 1997 Population structure of harbour porpoises Phocoena phocoena in the seas around the UK and adjacent waters. *Proceedings of the Royal Society of London Series B-Biological Sciences*, **264**, pp. 89-94.

82. Andersen, L. W., Ruzzante, D. E., Walton, M. J., Berggren, P., Bjorge, A. and Lockyer, C. 2001 Conservation genetics of harbour porpoises, *Phocoena phocoena*, in eastern and central North Atlantic. *Conservation Genetics*, **2**, pp. 309-324.

83. Jefferson, T. A., Leatherwood, S., & Webber, M. A. 1993 *FAO Species identification guide. Marine mammals of the world.* . UNEP / FAO, Rome.

84. Hammond, P. S., Berggren, P., Benke, H., Borchers, D. L., Collet, A., Heide-Jorgensen, M. P., Heimlich, S., Hiby, A. R., Leopold, M. F. and Øien, N. 2002 Abundance of harbour porpoise and other cetaceans in the North Sea and adjacent waters. *Journal of Applied Ecology*, **39**, pp. 361-376.

85. Rosel, P. E., France, S. C., Wang, J. Y. and Kocher, T. D. 1999 Genetic structure of harbour porpoise Phocoena phocoena populations in the northwest Atlantic based on mitochondrial and nuclear markers. *Molecular Ecology*, **8**, p. S41-S54.

86. Northridge, S. P., Tasker, M. L., Webb, A. and WILLIAMS, J. M. 1995 Distribution and relative abundance of harbor porpoises (*Phocoena-phocoena* L), white-beaked dolphins (*Lagenorhynchus-albirostris* Gray), and minke whales (*Balaenoptera-acutorostrata* Lacepede) around the British-isles. *Ices Journal of Marine Science*, **52**, pp. 55-66.

87. Weir, C. R., Pollock, C., Cronin, C. and Taylor, S. 2001 Cetaceans of the Atlantic Frontier, north and west of Scotland. *Continental Shelf Research*, **21**, pp. 1047-1071.

88. Canadas, A., Donovan, G. P., Desportes, G., & Borchers, D. L. in press *Distribution of short-beaked common dolphins (Delphinus delphis) in the central and eastern North Atlantic with an abundance estimate for part of this area*. NAMMCO Scientific Publications.

89. Stone, C. J. 2003 *The effects of seismic activity on marine mammals in UK waters, 1998-2000*. Aberdeen, JNCC Report No. 323.

90. Pollock, C. M., Mayor, R., Weir, C. R., Reid, A., White, R. W., Tasker, M. L., Webb, A., & Reid, J. B. 2000 *The distribution of seabirds and marine mammals in the Atlantic Frontier, north and west Scotland*. Aberdeen, UK.

91. Macleod, K. 2004 The abundance of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) during summer off north-west Scotland. *Journal of Cetacean Research and Management*, **6**, pp. 33-40.

92. Reeves, R. R., Smeenk, C., Brownell, R. L. and Kinze, C. C. 1999 Atlantic white-sided dolphin *Lagenorhynchus acutus* Gray, 1828. In *Handbook of marine mammals. Vol. 6. The second book of dolphins and the porpoises*, (eds S. H. Ridgway & R. G. Harrison, eds.), pp. 31-56. Academic Press, London.

93. Atkinson, T., Gill, A. and Evans, P. G. H. 1999 A photo-identification study of Risso's dolphin in the Outer Hebrides, northwest Scotland. *European Research on Cetaceans*, **12**, p. 102.

94. Kruse, S., Caldwell, D. K. and Caldwell, M. C. 1999 Risso's dolphin *Grampus griseus* (G. Cuvier, 1812). In *Handbook of Marine Mammals. Vol. 6.The second book of dolphins and porpoises*, (eds S. Ridgway & R. G. Harrison, eds.), pp. 183-212. Academic Press, London.

95. Couperus, A. S. 1993 Killer whales and pilot whales near trawlers east of Shetland. *Sula*, **7**, pp. 41-52.

96. Macleod, K., Simmonds, M. P. and Murray, E. 2003 Summer distribution and relative abundance of cetacean populations off north-west Scotland. *Journal of the Marine Biological Association of the United Kingdom*, **83**, pp. 1187-1192.

97. Luque, P. L., Davis, C. G., Reid, D. G., Wang, J. J. and Pierce, G. J. 2006 Opportunistic sightings of killer whales from Scottish pelagic trawlers fishing for mackerel and herring off North Scotland (UK) between 2000 and 2006. *Aquatic Living Resources*, **19**, pp. 403-410.

98. Foote, A. D., Víkingsson, G. A., Øien, N., Bloch, D., David, C. J., Dunn, T., Harvey, P., Mandleberg, L., Whooley, P. and Thompson, P. M. Distribution and abundance of killer whales in the North East Atlantic . International Whaling Commission.

99. Gunnlaugsson, T. and Sigurjonsson, J. 1990 NASS-87: Estimation of whale abundance based on observation made onboard Icelandic and Faroese survey vessels ship-board. *Report of the International Whaling Commision*, **40**, pp. 571-580.

100. Øien, N. 1990 Sightings surveys in the Northeast Atlantic in July 1988: distribution and abundance of cetaceans. *Report of the International Whaling Commission*, **40**, pp. 499-511.

101. Evans, P. G. H. 1988 Killer whales (*Orcinus orca*) in British and Irish waters. *Rit Fiskid.*, **11**, pp. 42-54.

102. Nichol, L. M. and Shackleton, D. M. 1996 Seasonal movements and foraging behaviour of northern resident killer whales (Orcinus orca) in relation to the inshore distribution of salmon (Oncorhynchus spp) in British Columbia. *Canadian Journal of Zoology-Revue Canadienne de Zoologie*, **74**, pp. 983-991.

103. Baird, R. W. 2000 The killer whale - foraging specializations and group hunting. In *Cetacean societies: field studies of dolphins and whales*, (eds J. Mann et al., eds.), pp. 127-153. University of Chicago Press.

104. Buckland, S. T., Bloch, D., Cattanach, K. L., Gunnlaugsson, T., Hoydal, K., Lens, S. and Sigurjonsson, J. 2003 Distribution and abundance of long-finned pilot whales in the North Atlantic, estimated from NASS-1987 and NASS-89 data. *Report of the International Whaling Commision*, **Special issue 14**, pp. 33-50.

105. Fullard, K. J., Early, G., Heide-Jorgensen, M. P., Bloch, D., Rosing-Asvid, A. and Amos, W. 2000 Population structure of long-finned pilot whales in the North Atlantic: a correlation with sea surface temperature? *Molecular Ecology*, **9**, pp. 949-958.

106. Cattanach, K. L., Sigurjonsson, J., Buckland, S. T. and Gunnlaugsson, T. 1993 Sei whale abundance, estimated from Icelandic and Faroese NASS-87 and NASS-89 data. *Report of the International Whaling Commision*, **43**, pp. 315-321.

107. Mate, B. R., Lagerquist, B. A., Winsor, M., Geraci, J. R. and PRESCOTT, J. H. 2005 Movements and dive habits of a satellite-monitored Longfinned pilot whale (Globicephala melas) in the northwest Atlantic. *Marine Mammal Science*, **21**, pp. 136-144.

108. Evans, P. G. H. 1992 *Status Review of Cetaceans in British and Irish waters.* Oxford, Report to UK Department of Environment.

109. Charif, R. A. & Clark, C. W. 2000 *Acoustic monitoring of large whales off north and west Britain and Ireland: a two-year study, October 1996-September 1998.* Peterborough, Joint Nature Conservation Committee Report No. 313.

110. Mendes, S. 2007 *Male sperm whales in the north Atlantic: insights into movements, distribution and foraging ecology*. PhD Thesis, University of Aberdeen.

111. Donovan, G. P. 1991 A review of IWC stock boundaries. *Report of the International Whaling Commission*, **Special Issue 13**, pp. 39-68.

112. Christensen, I., Haug, T. and Øien, N. 1992 Seasonal distribution, exploitation and present abundance of stocks of large baleen whales (Mysticeti) and sperm Whales (*Physeter macrocephalus*) in norwegian and adjacent waters. *Ices Journal of Marine Science*, **49**, pp. 341-355.

113. Whitehead, H. 2002 Estimates of the current global population size and historical trajectory for sperm whales. *Marine Ecology-Progress Series*, **242**, pp. 295-304.

114. Evans, P. G. H. 1997 Ecology of sperm whales (*Physeter macrocephalus*) in the Eastern North Atlantic, with special reference to sightings & strandings records from the British Isles. *Biologie* pp. 37-46.

115. Berrow, S. D., Evans, P. G. H. and Sheldrick, M. L. 1993 An analysis of sperm whale, *Physeter macrocephalus*, stranding and sighting records, from Britain and Ireland. *Journal of Zoology*, **230**, pp. 333-337.

116. Andersen, L. W., Born, E. W., Dietz, R., Haug, T., Øien, N. and Bendixen, C. 2003 Genetic population structure of minke whales Balaenoptera acutorostrata from Greenland, the North East Atlantic and the North Sea probably reflects different ecological regions. *Marine Ecology-Progress Series*, **247**, pp. 263-280.

117. Born, E. W., Outridge, P., Riget, F. F., Hobson, K. A., Dietz, R., Øien, N. and Haug, T. 2003 Population substructure of North Atlantic minke whales (Balaenoptera acutorostrata) inferred from regional variation of elemental and stable isotopic signatures in tissues. *Journal of Marine Systems*, **43**, pp. 1-17.

118. IWC 2007 Report of the joint NAMMCO/IWC scientific workshop on the catch history, stock structure and abundance of North Atlantic fin whales. *Journal of Cetacean Research and Management*, **9**.

119. Buckland, S. T., Cattanach, K. L. and Lens, S. 1992 Fin whale abundance in the eastern North Atlantic, estimated from Spanish NASS-89 data. *Report of the International Whaling Commision*, **42**, pp. 457-460.

120. North Atlantic Marine Mammal Commission 2003 *NAMMCO Annual Report 2003*. Tromsø, Norway.

121. Hooker, S. K., Whitehead, H., Gowans, S. and Baird, R. W. 2002 Fluctuations in distribution and patterns of individual range use of northern bottlenose whales. *Marine Ecology-Progress Series*, **225**, pp. 287-297.

122. Wimmer, T. and Whitehead, H. 2005 Movements and distribution of northern bottlenose whales, Hyperoodon ampullatus, on the Scotian Slope and in adjacent waters. *Canadian Journal of Zoology-Revue Canadienne de Zoologie*, **82**, pp. 1782-1794.

123. McSweeney, D. J., Baird, R. W. and Mahaffy, S. D. 2007 Site fidelity, associations, and movements of Cuvier's (*ziphius cavirostris*) and Blainville's (*mesoplodon densirostris*) beaked whales off the island of Hawaii. *Marine Mammal Science*, **23**, pp. 666-687.

124. IWC 2002 Report of the Scientific Committee. Annex H. Report of the Sub-Committee on the Comprehensive Assessment of North Atlantic Humpack Whales. *Journal of Cetacean Research and Management* pp. 230-260.

125. IWC 2003 Report of the Scientific Committee. Annex H. Report of the Sub-Committee on the Comprehensive Assessment of Humpack Whales. *Journal of Cetacean Research and Management*, **5**, pp. 293-323.

126. Evans, P. G. H. 1980 Cetaceans in British Waters. *Mammal Review*, **10**, pp. 1-52.

127. Pollock, C. M., Reid, J. B., Webb, A., & Tasker, M. 1997 *The distribution of seabirds and cetaceans in the waters around Ireland*. **Peterborough, UK**, JNCC Report No.267.

128. Sigurjonsson, J. & Gunnlaugsson, T. 1990 *Recent trends in abundance of blue (Balaenoptera musculus) and humpback whales (Megaptera novaeangliae) off west and southwest Iceland, with a note on occurrence of other cetacean species*. Report of the International Whaling Commission, 40.

129. Houghton, J. D. R., Doyle, T. K., Wilson, M. W., Davenport, J. and Hays, G. C. 2006 Jellyfish aggregations and leatherback turtle foraging patterns in a temperate coastal environment. *Ecology*, **87**, pp. 1967-1972.

130. Doyle, T. K., Houghton, J. D. R., McDevitt, R., Davenport, J. and Hays, G. C. 2007 The energy density of jellyfish: Estimates from bomb-calorimetry and proximate-composition. *Journal of Experimental Marine Biology and Ecology*, **343**, pp. 239-252.

131. ICES WGMME 2008 2008 *Report of the working group on marine mammal ecology*. ICES CM 2008/ACOM:44, St. Andrews, UK.

# 6. Appendices

## Appendix I - Context to the disturbance offences in the HR/OMR and WCA

**Please note this is non-statutory guidance.**

The offence of intentionally disturbing wild animals was first introduced in the UK in section 9 of the Wildlife and Countryside Act 1981 ('WCA'), and applied to the species listed in Schedule 5 to the Act within territorial waters, i.e. up to 12 nautical miles. Section 9 of the WCA was subsequently amended by the Countryside and Rights of Way Act 2000 (CRoW), to include both intentional and reckless disturbance.

The disturbance offence under the HR and the OMR does not completely mirror the disturbance offence under section 9 of the WCA. The WCA legislation applies to protected species listed in Schedule 5 of the WCA. Through the inclusion of some of the EPS in Schedule 5 (protected species) of the WCA, these species benefit from additional protection in respect of some of the offences under section 9, as set out in the table below.

Table 1. European Protected Species protected under the WCA

| **Species** | **Applicable sections** |
|---|---|
| Whales (all species) | 9(4A) and (5) |
| Dolphins | 9(4A) and (5) |
| Porpoises | 9(5) |
| Turtles *Flat back/Olive ridley* are applicable to all sections. | 9(4)(b) and (c) and (5) |

The offences covered in section 9 which are relevant to this guidance note are:

*(4) Subject to the provisions of this Part, a person is guilty of an offence if intentionally or recklessly -*
*(a) he damages or destroys any structure or place which any wild animal specified in Schedule 5 uses for shelter or protection;*
*(b) he disturbs any such animal while it is occupying a structure or place which it uses for shelter or protection; or*
*(c) he obstructs access to any structure or place which any such animal uses for shelter or protection.*

*(4A) Subject to the provisions of this Part, if any person intentionally or recklessly disturbs any wild animal included in Schedule 5 as -*
*(a) a dolphin or whale (Cetacea), or*
*(b) a basking shark (Cetorhinus maximus)*
*he shall be guilty of an offence.*

Section 9(5) of the WCA deals with offences relating to the sale and advertisement of such an animal and is not covered here.

In relation to s.9(4)(b) and 9(4A), points to note are that:

- Disturbance must be intentional or reckless. Both these terms have an established legal meaning.

- Disturbance is only an offence if the wild animal is disturbed while it is occupying a structure or place which it uses for shelter or protection. However, this limitation does not apply to the basking shark, whales or dolphins, which are covered by s.9(4A).
- Disturbance is not defined or qualified in any way, so it does not have to be 'significant' and could apply to the disturbance of an individual animal.

Based on case law, the word 'intentionally' should be interpreted as follows:

(a) a result is intended when it is the actor's purpose; or
(b) a court may infer that a result is intended, though it is not desired, when
(i) the result is a virtually certain consequence of the act, and
(ii) the actor knows that it is a virtually certain consequence.

In the case of the latter part of this definition, a court could convict if the prosecution could show that the action was virtually certain to cause disturbance, that the defendant knew this to be the case and that the defendant nonetheless proceeded with the act that resulted in the disturbance. This can be compared with the EC guidance on the strict protection of animal species[1], which suggests that an act is deliberate if 'a person who is reasonably expected to know that his action will *most likely* lead to an offence against a species, but intends the offence or, if not, at least accepts the result of his action'.

The concept of recklessness, as understood by the courts, has varied over the years. The current legal position is based on a judgement in 2003[i], favours a 'subjective' approach, whereby the court must consider the defendant's appreciation of risk. This case is the leading authority on the subject and held that a person acts recklessly -

(i) with respect to a circumstance when he is aware of a risk that exists or will exist, and
(ii) with respect to a result, when he is aware of a risk that it will occur; and it is, in the circumstances known to him, unreasonable to take the risk.

The person therefore acts recklessly if he was aware of a risk and, in the circumstances known to him it was unreasonable to take the risk.

**Defences**

Section 10 of the WCA sets out defences to the offences in section 9. The WCA retains, in relation to the offence of disturbing a Schedule 5 species, the defence that the act was the incidental result of a lawful operation and could not reasonably have been avoided[ii]. There are also two other defences available where the action causing the disturbance was carried out in pursuance of a requirement of the Secretary of State (in England) or the Welsh Ministers (in Wales) under section 98 of the Agriculture Act 1947, or was done under or in pursuance of an order made under the Animal Health Act 1981[iii].

It should be noted that those defences apply only in respect of the WCA disturbance offence, and they will not prevent a person from being found guilty of an offence under the HR or OMR.

Actions giving rise to the disturbance of Schedule 5 species can, in connection with specified purposes, be licensed by the appropriate authority under section 16(3) of the WCA, but the

[i] *R v G [2003] 1 Cr App R 2*
[ii] *section 10(3)(c)Wildlife and Countryside Act 1981, as amended*
[iii] *section 10(1) Wildlife and Countryside Act 1981, as amended*

purposes for which a licence may be granted do not include the carrying out of development. In order to avoid the commission of an offence under the WCA, any intentional or reckless disturbance of Schedule 5 species during development must therefore be covered by one of the defences referred to above.

**The relationship between the disturbance offences in the HR/OMR and the WCA**

The existence of two separate disturbance offences in two separate legislative frameworks presents a challenge of interpretation and application as they operate in different ways. The offence in the HR/OMR relates to deliberate disturbance, but may not apply to trivial disturbance, as described in this guidance, and may be licensable for imperative reasons of overriding public interest purposes which may, in some circumstances, enable a licence to be granted for the carrying out of development. The offence in the WCA relates to intentional or reckless disturbance, in a structure or place which the animal uses for shelter or protection (except whales, dolphins and basking sharks, where this restriction does not apply). Under the WCA, such disturbance is not licensable for the purposes of development, and is subject to an important defence [under section 10(3)] and two other defences [under section 10(1) - please see above].

## Appendix II - 'Favourable Conservation Status'

*Definition*

Article 1(i) of the Habitats Directive defines favourable conservation status (FCS) of a species as follows:

*"*conservation status of a species *means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2.*

*The* conservation status *will be taken as 'favourable' when:*
*- population*[iv] *dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
*-the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
*- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis"*

*Cetacean FCS assessments in UK waters*

Member states report back to the EC every six years on the conservation status of marine EPS (see http://www.jncc.gov.uk/page-4063). The UK assessed 6 out of 11 species of cetaceans as "Unknown" FCS, mainly as a result of the fact that either there were no recent population estimates that encompassed the natural range of a species in UK and adjacent waters, and/or there was no evidence to assess trends in population abundance. Another 17 species were

[iv] 'Population' is defined in the EC guidance on the strict protection of animal species (section I.2.2) as a group of individuals of the same species living in a geographic area at the same time that are (potentially) interbreeding (i.e. sharing a common gene pool).

considered to be uncommon, rare or very rare in occurrence, so it was not possible to ascertain their conservation status. Five species were assessed as 'favourable' FCS, however the reliability of these assessments was moderate to low. This means that:

a) a greater understanding of the species/population(s), or the factors affecting it, is required before a confident concluding judgment can be made by experts; and
b) the current estimate of population and/or trend are based on recent, but incomplete or limited survey data, or based predominately on expert opinion.

There are plans to identify conservation status assessment criteria that can be used in European waters and quantitative measures against which these assessments can realistically be made[131]. In addition, the UK is evaluating current monitoring of cetacean populations and considering the implementation of the future surveillance strategy for cetaceans.

## Appendix III - Common cetacean species in Annex IV occurring in UK and adjacent waters - Favourable Conservation Status assessment and best available abundance estimates*

| Latin name | Common name | FCS assessment | Abundance estimates (European waters) | Other relevant abundance estimates |
|---|---|---|---|---|
| *Balaenoptera acutorostrata* | Minke whale | Favourable | SCANS II[3]: 18,614 [95% CI = 10,445-33,171]<br>CODA: 6,765 [95% CI = 1,239-36,925]<br>(regional population structure) | 182,000 - whole North Atlantic<br>c.80,000 - Northeast Atlantic stock (IWC 2004) |
| *Balaenoptera physalus* | Fin whale | Favourable | CODA+: 7,523 [95% CI = 4,945-11,444] | 30,000 - Eastern and central North Atlantic (IWC) |
| *Delphinus delphis* | Common dolphin | Unknown | SCANS II: 63,366 [95% CI = 26,973-148,865]<br>CODA+: 162,266 [95% CI = 65,990-399,001] | 273,159 (95% CI: 153,392 - 435,104) - Western Block of the Faroes survey, NASS-95[88] |
| *Globicephala melas* | Long-finned pilot whale | Unknown | CODA+: 83,441 [95% CI = 33,875-205,528] | 778,000 (CV = 0.30), northern and north-east Atlantic range[101] |
| *Grampus griseus* | Risso's dolphin | Unknown | Unknown (100s, 1,000s) | |
| *Lagenorhynchus acutus* | White-sided dolphin | Unknown | 74,626 (CV=0.72), Faroe-Shetland Channel;<br>21,371 (CV=0.54), West of Outer Hebrides[91]. | |
| *Lagenorhynchus albirostris* | White-beaked dolphin | Favourable | SCANS II: 22,664 [95% CI = 10,341-49,670] | |
| *Orcinus orca* | Killer whale | Unknown | Unknown (1,000s) | |
| *Phocoena phocoena* | Harbour porpoise | Favourable | SCANS II: 385,617 [95% CI = 261,266-569,153]<br>(regional population structure) | |
| *Physeter macrocephalus* | Sperm whale | Unknown | CODA+: 2,424 [95% CI = 1,250 – 4,700] | |
| *Tursiops truncatus* | Bottlenose dolphin | Favourable | SCANS II: 12,645 [95% CI = 7,504-21,307]<br>CODA+: 19,295 [95% CI = 11,842-31,440]<br>(regional population structure in coastal populations) | Moray Firth - 129 [95% CI = 110-174];<br>Cardigan Bay - 213 [95% CI = 183-279] |

*The report on the implementation of the Habitats Directive, containing the species and habitats FCS reports is available online at http://www.jncc.gov.uk/page-4063.
+CODA survey results presented here are preliminary

## Appendix IV - FCS test and fraction of a population affected by disturbance/injury

The determination of how many animals could be 'removed' from a population without causing detrimental effects to the population at FCS in their natural range cannot easily be done. This will vary between species, depending primarily on the size of the population being considered and also its growth rate (difference between number of animals born and the number dying in each year). The removal of even one individual for a small population with relatively slow growth rates (such as those of coastal bottlenose dolphin populations) could potentially be detrimental to the population at FCS. However, for most populations of marine EPS in UK waters, the removal of tens, hundreds, and even thousands of animals for the most abundant species (e.g. harbour porpoise), would not result in detriment to the population at FCS.

The following factors should be considered when assessing what number of individuals could be 'removed' from the population through injury or disturbance (as defined in the Regulations) without compromising its FCS:

a) the numbers affected in relation to the best and most recent estimate of **population size**[i];

b) the **threshold** for potential impact on the FCS, which will depend on:

- the species'/populations' **life-history**;
- the species' **FCS assessment** in UK waters; and
- other pressures encountered by the population (**cumulative effects**).

*c) Population size*

The best available abundance estimates could be used as a baseline population size, taking account of any evidence of regional population structuring. For example, if in a certain area there is evidence supporting the existence of a population that has limited interbreeding with adjacent populations, or can be differentiated based on separate feeding or breeding grounds, then, separate abundance estimates should be used.

For abundance estimates in UK and adjacent waters please refer to the "Small Cetaceans in the European Atlantic and North Sea", SCANS II survey results[3] and the "Cetacean Offshore Distribution and Abundance in the European Atlantic" (CODA) survey results, and the IWC estimates for wide-ranging whale populations (see Section 4 and Appendix III). For coastal bottlenose dolphin populations there are abundance estimates derived from photo-identification studies (see species-specific section).

b*) Threshold for population impact*

The following factors should be considered for each species/population with animals likely to become exposed to injury or disturbance:

**Life-history**

In simple terms, the number of recruits to a population in any given year needs to be at least equal to the total mortality affecting the population (i.e. mortalities due to natural

[i] "Population" is defined here as a group of individuals of the same species living in a geographic area at the same time that are (potentially) interbreeding (i.e. sharing a common gene pool) following article 12 guidance. See appendix III.

mortality and human activities) for a population to remain the same size. The fraction of a population that could be affected beyond natural mortality will depend mainly on the population's potential growth rate. The higher the potential growth rate the higher the percentage of animals that could theoretically be removed from the population without causing it to decline.

The population growth rate will depend on several factors, e.g. how depleted a population is in relation to the environmental carrying capacity, the age structure and age-specific survival and fecundity, the age at first reproduction, the sex ratio and the reproductive capacity. The population growth rate is therefore likely to differ between species and even populations of a same species. For cetaceans the population growth rate is mostly unknown, although there are a few estimates for some populations in the world and it is generally accepted that cetacean population growth rates will be lower than 10% per year.

Population growth rates of between 3% and 13% per year have been reported for some baleen whale populations (www.iwcoffice.org/conservation/estimate.htm#table). Growth rates of 0 up to 5% have been reported for dolphin populations[26,27]. In terms of maximum potential growth rates, the estimated values for a population of Hector's dolphin[28] ranged between 1.8-4.9% per year and the estimated value for spotted and spinner dolphin in parts of the Pacific[29] was less that 4%. An IWC/ASCOBANS workshop in 2000 recommended that 4% a year should be used as a conservative estimate of the maximum potential growth rate for harbour porpoise. This value is generally accepted as the default for cetaceans, and in the absence of better information is considered a reasonable measure[30;31] that could be used.

Life-history parameters are currently not well known and will be difficult to obtain for most populations of cetaceans occurring in UK waters. In the absence of this information, a pragmatic, semi-quantitative approach should be adopted, as long as the uncertainty associated with the judgements is discussed in the assessments and reasonable conservative assumptions are made.

**Favourable Conservation Status assessment** (FCS, see Appendix II for a definition)
Effects on a certain number of animals as a result of the offences of injury or disturbance could have non-significant effects on a population that is doing well in terms of quality (e.g. reproductive success, age-structure) and quantity (stable or increasing size) and has good prospects of continuing to do so in future; but it could potentially have significant effects on a population with an 'unfavourable' assessment that might face many other pressures. This could differ for two species with similar population sizes but different FCS assessments.

**Cumulative effects**
The threshold for population impact should be adjusted if other pressures are known to affect the population in the area under consideration. For some populations of cetaceans, other human pressures (such as potential by-catch and contaminants) might be of more concern than the risk of injury or disturbance, while for others the disturbance could be an important added pressure.

## Appendix V - List of abbreviations

ADDs – Acoustic deterrent devices
AHD – Acoustic harassment devices
AMD – Acoustic mitigation devices
ASCOBANS - Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
CCW – Countryside Council for Wales
CEFAS – Centre for Environment, Fisheries and Aquaculture Science
CI – Confidence Intervals
CRoW - Countryside and Rights of Way Act 2000
CV – Coefficient of variation
DECC – Department of Energy and Climate Change
EIA - Environmental Impact Assessment
EPS – European Protected Species
FCS – Favourable Conservation Status
HR – Habitats Regulations
IWC – International Whaling Commission
JNCC – Joint Nature Conservation Committee
MMO – Marine Management Organisation
MMO – Marine Mammal Observer
MoD – Ministry of Defence
NE – Natural England
NIEA – Northern Ireland Environment Agency
OMR – Offshore Marine Regulations
PTS – Permanent Threshold Shift
SAC - Special Areas of Conservation
SNH - Scottish Natural Heritage
TTS – Temporary Threshold Shift
WAG – Welsh Assembly Government
WCA – Wildlife and Countryside Act

JNCC, Marine Advice,
Inverdee House, Baxter Street
Aberdeen, AB11 9QA,
United Kingdom
Tel: +44(0)1224 266550
Email: seismic@jncc.gov.uk

# ANNEX A - JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys

June 2010

## Introduction

The guidelines have been written for activities on the United Kingdom Continental Shelf (UKCS) and are aimed at reducing the risk of injury to negligible levels and can also potentially reduce the risk of disturbance from seismic surveys to marine mammals including seals, whales, dolphins and porpoises. Whilst there are no objections to these guidelines being used elsewhere JNCC would encourage all operators to determine if any special or local circumstances pertain, as we would not wish these guidelines to be used where a local management tool has already been adopted (for instance in the Gulf of Mexico OCS Region). In this context, JNCC notes that other protected fauna, for example turtles, will occur in waters where these guidelines may be used, and would suggest that, whilst the appropriate mitigation may require further investigation, the soft-start procedures for marine mammals would also be appropriate for marine turtles and basking sharks[i].

The guidelines require the use of trained Marine Mammal Observers (MMOs) whose role is to advise on the use of the guidelines and to conduct pre-shooting searches for marine mammals before commencement of any seismic activity. A further duty is to ensure that the JNCC reporting forms are completed for inclusion in the MMO report. In addition to the visual mitigation provided by MMOs, if seismic surveys are planned to start during hours of darkness or low visibility it is considered best practice to deploy Passive Acoustic Monitoring (PAM).

The 2010 version of the JNCC seismic guidelines reflects amendments (2007 and 2009 amendments) to the Conservation (Natural Habitats &c.) Regulations 1994 (Habitat Regulations, HR) for England and Wales[ii] and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (Offshore Marine Regulations, OMR**,** as amended in 2009 and 2010). Both regulations have revised the definition of deliberate disturbance of 'European Protected Species' (EPS), which now excludes trivial disturbance from the offence. Both regulations now also include the offence of deliberate injury. European Protected Species include cetaceans and turtles.

[i] Basking sharks are protected from intentional capture or disturbance in British waters (up to 12 miles offshore) under a 1998 listing on the Wildlife and Countryside Act (1981), Schedule 5.
[ii] In 2010 a consolidated version of the regulations came into force: The Conservation of Habitats and Species Regulations 2010.

It has been recognised that sound generated from seismic sources has the potential to cause injury and possibly also disturbance to marine mammals. Seismic surveys have therefore the potential to cause a deliberate injury offence as defined under regulations 41(1)(a) and 39(1)(a) and a deliberate disturbance offence as in 41(1)(b) and 39(1)(b) of the HR and OMR, respectively. The JNCC seismic guidelines reflect best practice for operators to follow during the planning, operational and reporting stages. **It is considered that compliance with the recommendations in these guidelines will reduce the risk of injury to EPS to negligible levels**.

**Please note that the mitigation measures recommended in the existing guidelines are more relevant to the prevention of injury rather than disturbance as defined in regulations 41(2) and 39(1A), of the HR and OMR, respectively. The onus should be on the entity responsible for the activity to assess whether a disturbance offence is likely to occur. Guidance on how to carry out such risk assessment is provided in the JNCC, NE and CCW document 'The protection of marine European Protected Species from injury and disturbance'.**

In relation to oil and gas seismic surveys in the UKCS, it is a requirement of the consent issued under regulation 4 of the Petroleum Activities (Conservation of Habitats) Regulations 2001 (& 2007 Amendments) by the Department for Energy Climate Change (DECC), that the JNCC Seismic Guidelines must be followed, and the elements of the guidelines that are relevant to a particular survey are incorporated into the legally-binding condition of consent. It should be noted that it is the responsibility of the company issued consent by DECC[iii], referred to in these guidelines as the 'applicant', to ensure that these guidelines are followed, and it is recommended that a copy of the JNCC guidelines are available onboard all vessels undertaking seismic activities in UK waters. Where relevant, when the survey is completed a MMO report must be submitted to the JNCC.



[iii] Department for Energy and Climate Change was formerly known as Department for Business and Regulatory Reform (BERR)

**Index**

## Terminology

**Marine European Protected Species:** These are marine species in Annex IV(a) of the Habitats Directive that occur naturally in the waters of the United Kingdom. These consist of several species of cetaceans (whales, dolphins and porpoises), turtles, and the Atlantic Sturgeon.

**Marine Mammal Observer (MMO)**: Individual responsible for conducting visual watches for marine mammals. For some seismic surveys it may be requested that observers are trained, dedicated and / or experienced. The MMO may also be a PAM operative if trained.

- **Trained MMO**: Has been on a JNCC recognised course
- **Dedicated MMO**: Trained observer whose role on board is to conduct visual watches for marine mammals (although it could double up as a PAM operative)
- **Experienced MMO**: Trained observer with 3 years of field experience observing for marine mammals, and practical experience of implementing the JNCC guidelines
- **PAM Operative**: Person experienced in the use of PAM software and hardware and marine mammal acoustics

**Mitigation Zone**: The area where a Marine Mammal Observer keeps watch for marine mammals (and delays the start of activity should any marine mammals be detected).

**Passive Acoustic Monitoring (PAM)**: Software system that utilises hydrophones to detect the vocalisations of marine mammals.

**Seismic Survey**: Any survey that uses airguns, including 2D/3D/4D and OBC (On-Bottom Cabling) surveys and any similar techniques that use airguns. Surveys using multibeam systems and sub-bottom profiling equipment such as boomers, pingers etc are not considered in these guidelines. However, the guidelines can be adapted and applied to the operation of such systems if considered appropriate.

**Shot Point Interval (SPI)**: Interval between firing of the airgun or airguns.

**Site Survey**: Seismic survey of a limited area proposed for drilling, infrastructure emplacement etc (typically with source size of 180 cubic inches or less).

**Soft-Start**: Turning on the airguns at low power and gradually and systematically increasing the output until full power is achieved (usually over a period of 20 minutes). The appropriate soft-start method is dependant upon the type of seismic survey and is discussed in section 3.

**United Kingdom Waters:** Parts of the sea in or adjacent to the United Kingdom from the low water mark up to the limits of the United Kingdom Continental Shelf.

**Vertical Seismic Profiling (VSP) or Borehole Seismic**: Seismic survey undertaken ‘down hole’ in connection with well operations (typically with a source size of 500 cubic inches).

## Section 1 – Assessing and minimising the risk of injury

### 1.1 The Planning Stage

When a seismic survey is being planned, the applicant should consider the following recommendations and best practice advice:

- Determine what marine mammal species are likely to be present in the survey area and assess if there are any seasonal considerations that need to be taken into account, for example periods of migration, breeding, calving or pupping. For UKCS activities the 'Atlas of cetacean distribution in north-west European waters' (Reid *et al*. 2003) is a useful starting point.
- Consult the latest relevant regulatory guidance notes; in the UK, DECC issues guidance notes for oil and gas seismic activities.
- As part of the environmental impact assessment, assess the likelihood of injuring or disturbing a European Protected Species. In the UK, it will be necessary to assess the likelihood of committing an offence as defined in the HR and in the OMR.
- Consult the JNCC, NE and CCW guidance on 'The protection of marine European Protected Species from injury and disturbance' to assist in the environmental impact assessment (www.jncc.gov.uk/page-4226).

The operator should whenever possible implement the following best practice measures:

- If marine mammals are likely to be in the area, only commence seismic activities during the hours of daylight when visual mitigation using Marine Mammal Observers (MMOs) is possible.
- Only commence seismic activities during the hours of darkness, or low visibility, or during periods when the sea state is not conducive to visual mitigation, if a Passive Acoustic Monitoring (PAM) system is in use to detect marine mammals likely to be in the area, noting the limitations of available PAM technology (seismic surveys that commence during periods of darkness, or low visibility, or during periods when the observation conditions are not conducive to visual mitigation, could pose a risk of committing an injury offence).
- Plan surveys so that the timing will reduce the likelihood of encounters with marine mammals. For example, this might be an important consideration in certain areas/times, e.g. during seal pupping periods near Special Areas of Conservation for common seals or grey seals.
- Provide trained MMOs to implement the JNCC guidelines.
- Use the lowest practicable power levels to achieve the geophysical objectives of the survey.
- Seek methods to reduce and/or baffle unnecessary high frequency noise produced by the airguns (this would also be relevant for other acoustic energy sources).

## Section 2 - Marine Mammal Observers

### 2.1. Role of an MMO

The primary role of an MMO is to act as an observer for marine mammals and to recommend a delay in the commencement of seismic activity should any marine mammals be detected. In addition, a MMO should be able to advise the crew on the procedures set out in the JNCC guidelines and to provide advice to ensure that the survey programme is undertaken in accordance with the guidelines. Before the survey commences it is important to attend any pre-mobilisation meetings to discuss the working arrangements that will be in place, and to request a copy of the survey consent issued by DECC (if applicable). An MMO may also work closely with Passive Acoustic Monitoring operatives. As the MMO role in relation to the vessel and survey operations is purely advisory, it is important to be aware of the command hierarchy and communication channels that will be in place, and determine who the main MMO / PAM operative contacts should be.

In a typical vessel based seismic survey, the MMO / PAM operative may pass advice to the party chief and client's representative through the navigators or seismic observers, and it is important to establish what the working arrangements are, as this may vary from one survey to the other. The MMOs should consider themselves as part of the crew and respect the chain of command that is in place.

MMOs should make certain that their efforts are concentrated on the pre-shooting search before the soft-start. These guidelines cannot be interpreted to imply that MMOs should keep a watch during all daylight hours, but JNCC would encourage all MMOs to manage their time to ensure that they are available to carry out a watch to the best of their ability during the crucial time - the 30 minutes before commencement of the firing of the seismic source (or 60 minutes if surveying where deep diving marine mammals are likely to be present). Whilst JNCC appreciates the efforts of MMOs to collect data at other times, this should be managed to ensure that those observations are not detrimental to the ability to undertake a watch prior to a soft-start. Where two MMOs are onboard a seismic vessel, JNCC would encourage collaboration to ensure that cetacean monitoring is always undertaken during all daylight hours.

### 2.2. Training requirements for MMOs

A prerequisite for an MMO to be classified as a 'trained MMO' is that they must have received formal training on a JNCC recognised course. (Further information on MMO course providers is available at: http://www.jncc.gov.uk/page-4703)

### 2.3. MMO equipment and reporting forms

MMOs should be equipped with binoculars, a copy of the JNCC guidelines and the 'Marine Mammal Recording Form' which is an Excel spreadsheet and has embedded worksheets named: 'Cover Page', 'Operations', 'Effort' and 'Sightings'. A Word document named 'Deckforms' is also available, and MMOs may prefer to use this when observing before transferring the details to the Excel spreadsheets.

The ability to determine range is a key skill for MMOs to have, and a useful tool to perform this function is a range finding stick.

All MMO forms, including a guide to completing the forms, and instructions on how to make and use a range finding stick are available on the JNCC website.

2.4. Reporting requirements – the MMO report

A report, the 'MMO report', should be sent to the JNCC after the survey has been completed. It is the responsibility of the consent holder to ensure that the MMO report is sent to JNCC. Ideally the MMO report should be sent via e-mail to seismic@jncc.gov.uk, or it can be posted to the address on the front page of these guidelines. Reports should include completed JNCC marine mammal recording forms and contain details of the following:

- The seismic survey reference number provided to the applicant by DECC.
- Date and location of survey.
- Total number and volume of the airguns used.
- Nature of airgun array discharge frequency (in Hz), intensity (in dB re. 1µPa or bar metres) and firing interval (seconds), and / or details of any other acoustic energy used.
- Number and types of vessels involved in the survey.
- A record of all occasions when the airguns were used.
- A record of the watches made for marine mammals, including details of any sightings and the seismic activity during the watches.
- Details of any problems encountered during the seismic survey including instances of non-compliance with the JNCC guidelines.

If there are instances of non-compliance with the JNCC guidelines that constitute a breach of the survey consent conditions, JNCC will copy the report, and their comments on the potential breach to DECC. It is therefore essential that MMO reports are completed as soon as possible after the survey has been completed.

## Section 3 – Guidance before and during seismic activity

All observations should be undertaken from the source vessel (where the airguns are being deployed from), unless alternative arrangements have been agreed with DECC. The MMO should be positioned on a high platform with a clear unobstructed view of the horizon, and communication channels between the MMO and the crew should be in place before commencement of the pre-shooting search (this may require portable VHF radios). The MMO should be aware of the timings of the proposed operations, so that there is adequate time to conduct the pre-shooting search. Figure 1 illustrates a typical seismic survey with decision making pathways in the event a marine mammal is detected.

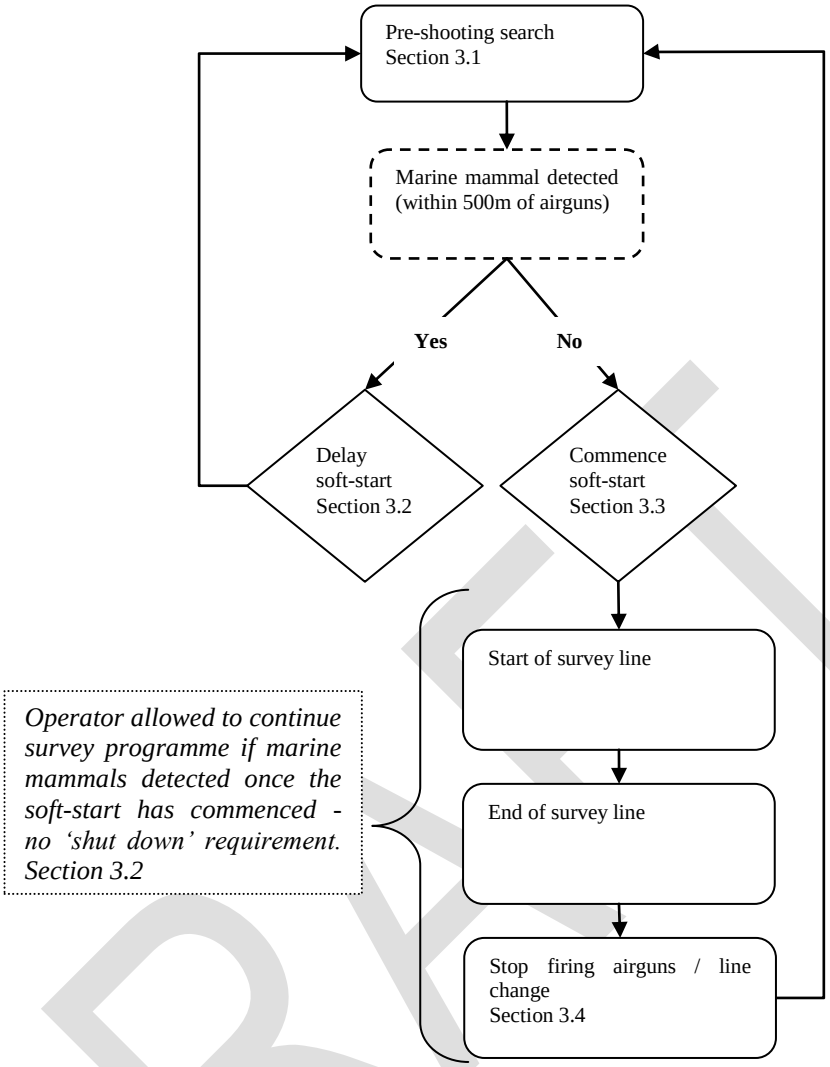



Figure 1. Flowchart illustrating the decision making pathway of a Marine Mammal Observer during a seismic survey.

## 3.1 Pre-shooting search

The pre-shooting search should normally be conducted over a period of 30 minutes before commencement of any use of the airguns. The MMO should make a visual assessment to determine if any marine mammals are within 500 metres of the centre of the airgun array.

In deep waters (>200m) the pre-shooting search should extend to 60 minutes as deep diving species (e.g. sperm whale and beaked whale) are known to dive for longer than 30 minutes. A longer search time in such areas is likely to lead to a greater detection and tracking of deep diving marine mammals.

To facilitate more effective timing of proposed operations when surveying in deeper waters, the searches for marine mammals can commence before the end of the survey line (whilst the airguns are still firing); this condition may be necessary for surveys which have relatively fast line turn times. If any marine mammals are

detected whilst the airguns are still firing, then no action is required other than for the MMO to monitor and track any marine mammals. The commencement of the soft-start for any subsequent survey lines should be delayed for at least 20 minutes if marine mammals are detected when the airguns have ceased firing.
If PAM is used in conjunction with visual monitoring the PAM operatives should ensure the system is deployed and being monitored for vocalisations during each designated pre-shooting period.

3.2 Delay if marine mammals are detected within the mitigation zone (500 metres)

If marine mammals are detected within 500 metres of the centre of the airgun array during the pre-shooting search, the soft-start of the seismic sources should be delayed until their passage, or the transit of the vessel, results in the marine mammals being more than 500 metres away from the source. In both cases, there should be a 20 minute delay from the time of the last sighting within 500 metres of the source to the commencement of the soft-start, in order to determine whether the animals have left the area. If PAM is used it is the responsibility of the PAM operatives to assess any acoustic detections and determine if there are likely to be marine mammals within 500 metres of the source. If the PAM operatives consider marine mammals are present within that range then the start of the operation should be delayed as outlined above.

If marine mammals are detected within 500 metres of the centre of the airgun array whilst the airguns are firing, either during the soft-start procedure or whilst at full power, there is no requirement to stop firing the airguns.

In situations where seal(s) are congregating around a drilling or production platform that is within the survey area, it is recommended that the soft-start should commence at a location at least 500 metres from the platform.

3.3 The soft-start

The soft-start is defined as the time that airguns commence shooting till the time that full operational power is obtained. Power should be built up slowly from a low energy start-up (e.g. starting with the smallest airgun in the array and gradually adding in others) over at least 20 minutes to give adequate time for marine mammals to leave the area. This build up of power should occur in uniform stages to provide a constant increase in output. There should be a soft-start every time the airguns are used, the only exceptions being for certain types of airgun testing (section 3.3.2), and the use of a ‘mini-airgun’ (single gun volume less than 10 cubic inches), these are used on site-surveys (section 3.3.1). The duration of the pre-shooting search (at least 30 minutes) and the soft-start procedure (at least 20 minutes) should be factored into the survey design.

General advice to follow for soft-starts:

- To minimise additional noise in the marine environment, a soft-start (from commencement of soft-start to commencement of the line) should not be significantly longer than 20 minutes (for example, soft-starts greater than 40

minutes are considered to be excessive, and an explanation should be provided within the MMO report).

- Where possible, soft-starts should be planned so that they commence within daylight hours.
- Once the soft-start has been performed and the airguns are at full power the survey line should start immediately. Operators should avoid unnecessary firing at full power before commencement of the line.
- If, for any reason, firing of the airguns has stopped and not restarted for at least 10 minutes, then a pre-shooting search and 20 minute soft-start should be carried out (the requirement for a pre-shooting search only applies if there was no MMO on duty and observing at this time, and if the break in firing occurred during the hours of daylight). After any unplanned break in firing for less than 10 minutes the MMO should make a visual assessment for marine mammals (not a pre-shooting search) within 500 metres of the centre of the airgun array. If a marine mammal is detected whilst the airguns are not firing the MMO should advise to delay commencement, as per the pre-shooting search, delay and soft start instructions above. If no marine mammals are present then they can advise to commence firing the airguns.
- When time-sharing, where two or more vessels are operating in adjacent areas and take turns to shoot to avoid causing seismic interference with each other, the soft-start and delay procedures for each vessel should be communicated to, and applied on, all the vessels involved in the surveying.

### 3.3.1 Soft-start requirements for site survey or Vertical Seismic Profiling (VSP)

Surveys should be planned so that, whenever possible, the soft-start procedures for site surveys and Vertical Seismic Profiles (VSP's) commence during daylight hours. Whilst it is appreciated that high resolution site surveys / VSP operations may produce lower acoustic output than 2D or 3D surveys it is still considered desirable to undertake a soft-start to allow for marine mammals to move away from the seismic source.

For ultra high resolution site surveys that only use a 'mini-airgun' (single airgun with a volume of less than 10 cubic inches) there is no requirement to perform a soft-start, however, a pre-shooting search should still be conducted before its use.

For site surveys and VSPs, a number of options are available to effect a soft-start.

- The standard method, where power is built up slowly from a low energy start-up (e.g. starting with the smallest airgun in the array and gradually adding in others) over at least 20 minutes to give adequate time for marine mammals to leave the vicinity.
- As the relationship between acoustic output and pressure of the air contained in the airgun is close to linear and most site surveys / VSP operations use only a small number of airguns and a soft-start can be achieved by slowly increasing the air pressure in 500 psi steps. From our understanding, the minimum air pressure which the airgun array can be set to will vary, as this is dependent on the make and model of the airgun being used. The time from initial airgun start up to full power should be at least 20 minutes.

- Over a minimum time period of 20 minutes the airguns should be fired at an increasing frequency (by decreasing the Shot Point Interval (SPI)) until the desired firing frequency is reached.

### 3.3.2 Soft-starts and airgun testing

Airgun tests may be required before a survey commences, or to test damaged or misfiring guns following repair, or to trial new arrays. Individual airguns, or the whole array may need testing, and the airguns may be tested at varying power levels. The following guidance is provided to clarify when a soft-start is required:

- If the intention is to test all airguns at full power then a 20 minute soft-start is required.
- If the intention is to test a single airgun on low power then a soft-start is not required.
- If the intention is to test a single airgun, or a number of guns on high power, the airgun or airguns should be fired at lower power first, and the power then increased to the level of the required test; this should be carried out over a time period proportional to the number of guns being tested and ideally not exceed 20 minutes in duration.

MMOs should maintain a watch as outlined in the pre-shooting search guidance (section 3.1) before any instances of gun testing.

## 3.4 Line Change

Seismic data is usually collected along predetermined survey lines. Line change is the term used to describe the activity of turning the vessel at the end of one line prior to commencement of the next line. Depending upon the type of seismic survey being undertaken, the time for a line change can vary. Line changes are not necessary for all types of seismic surveys, for example, in certain regional surveys where there is a significant distance between the lines, and for VSP operations.

The guidance relating to line change depends upon the airgun volume.

### 3.4.1 Seismic surveys with an airgun volume of 500 cubic inches or more

- If the line change time is expected to be greater than 20 minutes, airgun firing should be terminated at the end of the line and a full 20 minute soft-start undertaken before the next line. A pre-shooting search should also be undertaken during the scheduled line change, and the soft-start delayed if marine mammals are seen within 500 metres of the centre of the airgun array.

### 3.4.2 Seismic surveys with an airgun volume of 180 cubic inches or less (site surveys)

- If the line change time is expected to be greater than 40 minutes, airgun firing should be terminated at the end of the line and a full 20 minute soft-start undertaken before the next line. The pre-shooting search should also be

undertaken during the scheduled line change, and the soft-start delayed if marine mammals are seen within 500 metres of the centre of the airgun array.

- If the line change time is expected to be less than 40 minutes, airgun firing can continue during the turn, but the Shot Point Interval (SPI) should be increased (longer duration between shots). Ideally, the SPI should not exceed 5 minutes during the turn.

Depending upon the duration of the line turns and the nature of seismic survey it may be necessary to vary the soft-start procedures. If an applicant determines that an effective line change can not be achieved using the above methods please contact JNCC at the earliest possible opportunity to discuss the proposed alternative, and include the details of the agreed procedure and the consultation with the JNCC in the application for survey consent.

### 3.5 Undershoot operations

During an undershoot operation, one vessel is employed to tow the seismic source and a second vessel used to tow the hydrophone array, although the main vessel will still tow the hydrophone array. This procedure is used to facilitate shooting under platforms or other obstructions. The MMO may be too far away from the airguns to effectively monitor the mitigation zone, and it is therefore recommended to place the MMO on the source vessel. If this is not possible, for example for logistical reasons, or the health and safety implications of transferring personnel from one vessel to another, the application should explain that the recommended procedure cannot be followed in the application for the survey consent, or the application for a variation of that consent. Irrespective of the MMO location agreed with DECC, the pre-shooting search and soft-start procedures should still be followed prior to undertaking an undershoot operation.

## Section 4 - Acoustic Monitoring

Visual observation is an ineffective mitigation tool during periods of darkness or poor visibility (such as fog), or during periods when the sea state is not conducive to visual mitigation, as it will not be possible to detect marine mammals in the vicinity of airgun sources. Under such conditions, PAM is considered to be the only currently available mitigation technique that can be used to detect marine mammals. Current PAM systems can be particularly helpful in detecting harbour porpoises within the 500 metre mitigation zone, although the systems have their limitations and can only be used to detect vocalising species of marine mammals.

PAM systems consist of hydrophones that are deployed into the water column, and the detected sounds are processed using specialised software. PAM operatives are needed to set up and deploy the equipment and to interpret the detected sounds.

### 4.1 Use of PAM as a mitigation tool

PAM can provide a useful supplement to visual observations undertaken by MMOs and JNCC may recommend that it is used as a mitigation tool when commenting on applications for survey consents. However, in many cases it is not as accurate as

visual observation for determining range, and this will mean that the mitigation zone will reflect the range accuracy of the system. For example, if the range accuracy of a system is estimated at +/-300 metres, animals detected and calculated to be within 500 metres from the source could, in reality, be 500 + 300 = 800 metres, but their detection would still lead to a delay in the soft-start. Although, at present it is not possible to express the range accuracy of most PAM systems in numerical terms, this example serves to illustrate that it is in the operator's best interests to use the most accurate system available, and for the PAM operative to factor in a realistic estimate of the range accuracy.

Some PAM systems do not have a reliable range determination facility or can only calculate the range for some species. In such cases, the detection of a confirmed cetacean vocalisation should still be used to initiate postponement of the soft-start if the PAM operator is able to make a judgement about the range of the animals from the airgun source, because of their experience gained in differentiating between distant and close vocalisations. In the absence of PAM systems capable of range determination, this expert judgement will constitute the basis for deciding whether an area is free from cetaceans prior to the soft-start.

In all cases where PAM is employed, a brief description of the system and an explanation of how the applicant intends to deploy PAM to greatest effect should be included in the application for survey consent.

In the last few years, software that processes and analyses cetacean sounds has been developed. An example of this is PAMGuard, an open source software that has been developed as part of the International Association of Oil and Gas Producers Joint Industry Project (JIP). JNCC recognises that PAMGuard is currently in a transition period between use as a research tool and widespread adoption as a monitoring technique. Moreover, JNCC recognises the need to balance proactive implementation of PAM with the need to further develop its capability, for example to include species recognition and baleen whale detection, and therefore encourages users of these systems to actively contribute to their development and refinement.

**Section 5 – Requirements for MMOs and PAM**

Any survey application or consultation received by JNCC will be considered on a case-by-case basis, and the mitigation measures advised to DECC will reflect the particulars of the survey and the importance of the survey area for marine mammals. The following paragraphs are provided as a guide to the advice applicants are likely to receive following submission of an application with JNCC.

For areas that are currently considered particularly important for marine mammals, for example in the UK this includes areas West of Scotland, the Moray Firth and Cardigan Bay, JNCC may recommend that:

- The MMOs should be experienced MMOs, and that PAM should be used.
- The PAM system should be used to supplement visual observations, or as the main mitigation tool if the seismic survey activity commences during periods of

darkness or poor visibility, or during periods when the sea state is not conducive to visual mitigation.

JNCC will advise that two marine mammal observers should be used when daylight hours exceed approximately 12 hours per day (between 1st April and 1st October north of 57$^{O}$ latitude), or the survey is in an area considered particularly important for marine mammals.

When a non-dedicated MMO is recommended by JNCC (e.g. for VSPs and certain site-surveys), and the recommendation is incorporated into the conditions of the survey consent, a member of the rig's or vessels crew can perform the duties providing the crew member is a trained MMO.

When a dedicated MMO is recommended and this is a condition of the survey consent, the MMO should be employed solely for the purpose of monitoring the implementation of the guidelines and undertaking visual observations to detect marine mammals during periods of seismic activity.

When two dedicated MMOs are requested and this is a condition of the survey consent, both should be employed solely for the purposes of monitoring the implementation of the guidelines and undertaking visual observations, and the use of a crew member with other responsibilities as the second observer is not considered to be an adequate substitute for a dedicated MMO, or to be in compliance with the conditions of the survey consent.

## Section 6 - Background Information

These guidelines were originally prepared by a Working Group convened by the Department of the Environment, and were developed from a draft prepared by the Sea Mammal Research Unit (SMRU). The guidelines have subsequently been reviewed three times by the Joint Nature Conservation Committee, following consultation with interested parties.

### 6.1. Existing protection to cetaceans

Section 9 of the Wildlife and Countryside Act 1981 (CRoW amended) prohibits the intentional or reckless killing, injuring or disturbance of any cetacean. The UK is also a signatory to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) and has applied its provisions in all UK waters. Amongst other actions required to conserve and manage populations of small cetaceans, ASCOBANS requires range states to "work towards...the prevention of ...disturbance, especially of an acoustic nature".

Reflecting the requirements of the Convention on the Conservation of European Wildlife and Habitats (the Bern Convention) and Article 12 of the EC Habitats and Species Directive (92/43/EEC), the UK has the following legislation in place:

- The Conservation of Habitats and Species Regulations 2010
- The Conservation (Natural Habitats, &c.) Regulations 1995 (Northern Ireland) (and 2009 amendments)

- The Conservation (Natural Habitats, &c.) Amendment (No. 2) Regulations 2008 (Scotland) (and 2009 amendments)
- The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (and 2007 Amendments),
- The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (and 2009 and 2010 amendments) (beyond 12 nautical miles UKCS)

**Section 7 – References and contacts**

Further information on DECC's survey consent procedure can be found at: http://www.og.berr.gov.uk/.

A copy of these guidelines, the standard forms (electronic and hard copy) and further background information is available from the above address, or can be found on the JNCC website at: http://www.jncc.gov.uk/page-1534

Reid, J.B., Evans, P.G.H., & Northridge, S.P. (2003). *'Atlas of cetacean distribution in north-west European waters'* (On-line). **http://www.jncc.gov.uk/page-2713**

If you have any comments or questions relating to these guidelines, or suggestions on how they may be improved, please email seismic@jncc.gov.uk

JNCC, Marine Advice,
Inverdee House, Baxter Street
Aberdeen, AB11 9QA,
United Kingdom
Tel: +44(0)1224 266550
Email: seismic@jncc.gov.uk

# ANNEX B - Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise

June 2010



## Introduction

This document, which has been produced by Natural England, the Countryside Council for Wales and the Joint Nature Conservation Committee, outlines a protocol for the mitigation of potential underwater noise impacts arising from pile driving during offshore wind farm construction. This protocol may also be useful to other industries in the marine environment which use pile driving. The agencies recommend that all operations that include pile driving should consider producing an Environmental Management Plan (EMP), or an equivalent document that meets the requirements of the relevant regulator.

The nature conservation agencies' policies support appropriately sited offshore renewable energy developments because they can provide environmental benefits to species of conservation concern, including marine mammals, by reducing greenhouse gas emissions and mitigating adverse climate change impacts. However, these developments can adversely affect species and features of conservation importance, including those protected by European and domestic Law. Mitigation of such impacts forms an intrinsic part of the Environmental Impact Assessment (EIA) process required as part of the consenting process for offshore windfarms.

The installation of driven piles in the marine environment without mitigation is likely to produce noise levels capable of causing injury and disturbance to marine mammals. Such effects, although incidental to consented activities, have the potential to conflict with the legislative provisions of The Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations', HR), which applies to English and Welsh waters inside 12 nautical miles (nm), and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (the 'Offshore Marine Regulations', OMR, as amended 2009 and 2010), which apply on the United Kingdom Continental Shelf.

JNCC, NE and CCW have produced guidance on 'the protection of marine European protected species from injury and disturbance'. The piling protocol forms part of that more general guidance and the recommendations should be considered as 'best practice' for piling operations.

JNCC notes that other protected fauna, for example turtles, occur in waters where these guidelines may be used, and would suggest that, whilst the appropriate mitigation may require further investigation, the protocols recommended for marine mammals would also be appropriate for marine turtles and basking sharks[i].

Scientific understanding of the issues discussed in this piling protocol is incomplete, but improving. It is therefore important to note that the piling protocol is not considered to be static policy and will be subject to regular revision following on from experience of its use, and the development of a better understanding of the efficacy of certain mitigation measures recommended in the protocol.

Pile driving in the marine environment without mitigation is likely to produce noise levels capable of inducing adverse avoidance reactions at a considerable distance from the activity, which could constitute disturbance under the Regulations (HR and OMR depending on the area). Pile driving is also likely to cause injuries (e.g. hearing impairment) and there remains the possibility of causing death in marine mammals that are in very close proximity.

**This protocol does not document measures to mitigate disturbance effects, but has been developed to reduce to negligible levels the potential risk of injury or death to marine mammals in close proximity to piling operations.**

**If the risk of disturbance cannot be avoided or reduced to negligible levels, the developers need to obtain a licence under regulations 53/49 (HR/OMR respectively) in order to avoid the application of regulations 41(1)(b) and 39(1)(b) of the HR/OMR.**



[i] Basking sharks are protected from intentional capture or disturbance in British waters (up to 12 miles offshore) under a 1998 listing on the Wildlife and Countryside Act (1981), Schedule 5.

**Index**



**Terminology**

**Marine European Protected Species:** These are marine species in Annex IV(a) of the Habitats Directive that occur naturally in the waters of the United Kingdom. These consist of several species of cetaceans (whales, dolphins and porpoises), turtles, and the Atlantic Sturgeon.

**Marine Mammal Observer (MMO)**: Individual responsible for conducting visual watches for marine mammals. It may be requested that observers are trained, dedicated and/or experienced. The MMO may also be a PAM operative.

- **Trained MMO**: Has been on a JNCC recognised course

- **Dedicated MMO**: Trained observer whose role on board is to conduct visual watches for marine mammals (although it could double up as a PAM operative)
- **Experienced MMO**: Trained observer with 3 years of field experience observing for marine mammals, and practical experience of implementing the JNCC guidelines
- **PAM Operative**: Person experienced in the use of PAM software and hardware and marine mammal acoustics

**Mitigation Zone**: The area where a Marine Mammal Observer keeps watch for marine mammals (and delays the start of activity should any marine mammals be detected).

**Passive Acoustic Monitoring (PAM)**: Software system that utilises hydrophones to detect the vocalisations of marine mammals.

## Section 1 - The Standard Piling Protocol

The standard protocol should be recommended to developers as a minimum level of good practice to mitigate the potential for causing injury or death to marine mammals in close proximity to piling operations.

Many of the techniques in the standard piling protocol have their origins in the 'JNCC seismic guidelines'. As the levels of noise associated with seismic survey can, in some cases, be similar to those likely to arise from piling operations, it is appropriate to adopt comparable mitigation measures. Additionally, many of the elements of the protocol have already been incorporated as FEPA licence conditions for Round 1 and 2 offshore windfarms, following advice provided by the statutory nature conservation agencies (Section 5).

### 1.1 The planning stage

The developer should consult JNCC, NE and CCW guidance on 'the *protection of marine European Protected Species from injury and disturbance*' to assist in environmental impact assessment.

The recommendations detailed below should be considered by the developer during the planning stage and be incorporated into the project's Environmental Management Plan or the equivalent document required by the relevant regulator.

#### 1.1.1 Developer to demonstrate that Best Available Technique (BAT) is being used

BAT, which incorporates the previous concept of BATNEEC (Best Available Technique Not Entailing Excessive Cost), is an established approach in environmental management. It seeks to balance the highest level of environmental protection against commercial affordability and practicality.

The demonstration of BAT may require developers to submit commercially sensitive information to the agencies. For example, the costing of different pile construction

techniques is likely to be confidential. There may, understandably, be concerns about this process and, in such cases, the agencies will agree an approach with the developers and the regulators (currently the MMO for offshore windfarm developments covered by this protocol) to regulate this process.

Techniques such as hammer modifications, sleeving or muffling, the use of vibratory hammers and gravity based piling may all reduce noise levels. The developer may be able to demonstrate that certain installation approached do not amount to BAT, and this can be achieved by submitting a detailed business case involving analysis of cost and impact on margins. The use of gravity base piles is particularly notable, because potential noise impacts area likely to be much reduced. In contrast, the COWRIE work has gone some way to demonstrate that the use of unenclosed bubble curtains, bubble trees[ii] or enclosure coffer dams[iii] is currently ineffective or uneconomical.

### 1.1.2 Consideration of the local environment

The developer must determine what marine mammal species are likely to be present in the area and assess if there are any seasonal considerations that need to be taken into account. Seasonal restrictions on piling operations may be necessary. For example this may be appropriate during periods of seal pupping, and when there is clear seasonal demarcation in animal occurrence and seasonal restrictions would have practical application[iv]. The interaction with other potential spatial and temporal restrictions on construction times (for example in spring to mitigate impacts on commercial fish spawning or during winter to reduce impacts on certain seabirds) would also need to be considered.

## 1.2 Role of the Marine Mammal Observer (MMO)

Operators should seek to provide dedicated MMOs and Passive Acoustic Monitoring (PAM) operatives. Piling activities should be monitored by MMOs and PAM operatives whose primary role is to detect marine mammals and to potentially recommend a delay in the commencement of piling activity if any marine mammals are detected. In addition, the MMO / PAM operatives should be able to advise the crew on the implementation of the procedures set out in the agreed mitigation protocol, to ensure compliance with those procedures.

### 1.2.1 Training requirements for MMOs

MMOs should be appropriately trained and understand the mitigation procedures within the piling protocol. MMOs should be present in sufficient numbers to ensure that monitoring is not compromised by fatigue. They should ensure they receive a copy of the mitigation procedures requested by the regulating authority as they may

[ii] Bubble curtains and bubble trees release streams of bubbles into the water column - because of tidal flows such bubbles are likely to dissipate in the environments associated with offshore windfarms.

[iii] Not commercially feasible currently because of the time taken to install them, particularly in the offshore environment.

[iv] Seasonal restrictions which would restrict piling for large parts of the year and which might therefore make a project uneconomic may not be welcomed by the operator. In such cases where the impact assessments showed risk of a disturbance offence, the operator may wish to consider alternative methods, for example such as the use of gravity piles.

vary between activities. JNCC has approved a number of MMO course providers[v] – although the courses they run deal primarily with the seismic guidelines, the skills are easily transferable to the monitoring of piling activities.

### 1.2.2 Equipment required by the MMO

MMOs should be equipped with binoculars, a copy of the agreed monitoring protocol and the 'Marine Mammal Recording Form', which is an Excel spreadsheet containing embedded worksheets named 'Cover Page', 'Operations', 'Effort' and 'Sightings'. A Word document named 'Deck forms' is also available, and MMOs may prefer to use this when observing before transferring the details to the Excel spreadsheets. Although these forms were developed for seismic surveys, they can be used for piling operations, although many columns will not be applicable.

The ability to determine range of marine mammals is a key skill for MMOs, and a useful tool is a range finding stick. All MMO forms, including a guide to completing the forms, and instructions on how to make and use a range finding stick, are available on the JNCC website.

## 1.3 Passive Acoustic Monitoring (PAM) and PAM operatives

PAM systems consist of hydrophones that are deployed into the water column, and the detected sounds are processed using specialised software. PAM operatives are needed to set up and deploy the equipment, and to interpret the detected sounds. A PAM operative could also be a trained MMO, and this would allow them to switch roles, if required, between acoustic and visual monitoring (providing that there is another trained PAM operative available). Switching roles between acoustic and visual monitoring could help alleviate observer fatigue.

In its current state of development, PAM systems are particularly useful in detecting harbour porpoises within a 500 metre mitigation zone, although the systems have their limitations and can only be used to detect vocalising species of marine mammals.

PAM can provide a useful supplement to visual observations undertaken by MMOs and the agencies may recommend that it is used as a mitigation tool when commenting on applications for piling consents. However, in many cases it is not as accurate as visual observation for determining range, and this will mean that the mitigation zone will reflect the range accuracy of the system. For example, if the range accuracy of a system is estimated at +/-300 metres, animals detected and calculated to be within 500 metres from the source could, in reality, be 500 + 300 = 800 metres, but their detection would still lead to a delay in the soft-start. Although, at present it is not possible to express the range accuracy of most PAM systems in numerical terms, this example serves to illustrate that it is in the developer's best interests to use the most accurate system available, and for the PAM operative to factor in a realistic estimate of the range accuracy.

[v] The JNCC website has a list of MMO course providers: http://www.jncc.gov.uk/page-4703

## 1.4 Communication

At the planning stage the communication channels between those providing the mitigation service and the crew working on the piling are to be established. The MMO and PAM operatives also have to ensure there is a workable communication procedure in place so that any visual and acoustic detections can be corroborated by both. In addition, a formal chain of communication from the MMO or PAM operative to the person who can start/stop piling operations must be established. This is important, because construction contractors working to a tight timetable may not fully appreciate the roles and responsibilities of the MMO and PAM operatives. In order to establish the chain of communication and command MMOs and PAM operatives should attend any relevant pre-mobilisation meetings.

## 1.5 Mitigation zone

It is necessary to establish a "mitigation zone" of a pre-agreed radius around the piling site prior to any piling. This is an area in which the MMO / PAM operative will monitor either visually and/or acoustically for marine mammals before piling commences. The extent of this zone should be considered during the environmental impact assessment and agreed with the regulatory authority.

The extent of this zone represents the area in which a marine mammal could be exposed to sound that could cause injury and will be determined by factors such as the pile diameter, the water depth, the nature of the activities (for example whether drilling will also take place) and the effect of the substrate on noise transmission. The radius of the mitigation zone should be no less than 500 metres, and this is measured from the pile location (figure 1). The MMO and PAM operative should be located on the most appropriate viewing platform (e.g. vessel) to ensure effective coverage of the mitigation zone. The MMO will also require a platform that provides a good all-round view of the sea.

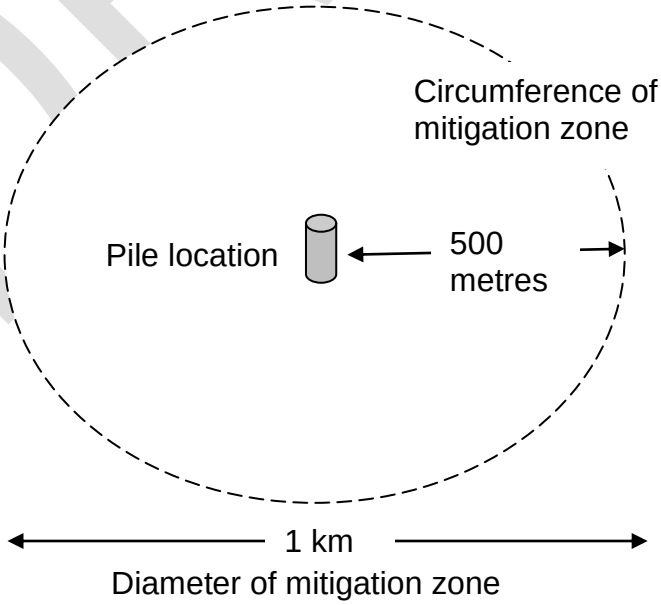



Figure 1: A representation of the mitigation zone, this is measured from the location of the pile to be installed out to a distance of 500 metres.

## Section 2 – Advice during the piling activity

The following recommendations are relevant during piling operations.

### 2.1 Piling at night or poor visibility

Piling should not be commenced during periods of darkness or poor visibility (such as fog), or during periods when the sea state is not conducive to visual mitigation (above Sea State 4[vi]), as there is a greater risk of failing to detect the presence of marine mammals. Variations to this restriction on commercial grounds are discussed in section 4.

### 2.2 Pre-Piling Search

The mitigation zone should be monitored visually by MMOs and/or acoustically using PAM for an agreed period prior to the commencement of piling. It is recommended that the pre-piling search duration should be a minimum of 30 minutes[vii].

### 2.3 Delay if marine mammals detected within mitigation zone

Piling should not be commenced if marine mammals are detected within the mitigation zone or until 20 minutes[viii] after the last visual or acoustic detection. The MMO and PAM operative should track any marine mammals detected and ensure they are satisfied the animals have left the mitigation zone before they advise the crew to commence piling activities.

### 2.4 Soft-Start of pile driver

The soft-start is the gradual ramping up of piling power, incrementally over a set time period, until full operational power is achieved. The soft-start duration should be a period of not less than 20 minutes[ix]. It is believed that by initiating piling at a lower power this will allow for any marine mammals to move away from the noise source, and reduce the likelihood of exposing the animal to sounds which can cause injury. Soft-start noise levels will vary according to hammer and pile design and other factors, and should be assessed as part of the environmental impact assessment process. Developers might want an alternative soft-start duration depending upon the

[vi] Detection of marine mammals, particularly porpoises, will decrease as sea-state increases. While ideally sea-states of 2 or less, are required for optimal visual detection the risks of not detecting individuals within the MZ should be reduced by the combined use of visual monitoring and PAM.

[vii] This 30 minute period is used in the JNCC seismic survey guidance

[viii] A 20 minute period is adopted by the JNCC seismic survey guidance. Issues of swimming speed and noise dosage are considered in the Thame Developer report - it is considered that twenty minutes is a sufficient period of time to allow individuals to be at a distance where risk of injury or death is minor.

[ix] The details of soft-start will vary according to substrate type, pile design and the hammer utilised. Measurements from the Lynn and Inner Dowsing test pile suggest that while “soft-start” levels are considerably lower than those occurring during full power piling they are still capable of giving rise to injury. Details of the soft-start procedure should be obtained for each project (see draft FEPA conditions Section 5).

specifics of the project and outcomes of the EIA process; any requested variation from a 20 minute soft-start should be agreed with the relevant agency and regulator.

If a marine mammal enters the mitigation zone during the soft-start then, whenever possible, the piling operation should cease, or at the least the power should not be further increased until the marine mammal exists the mitigation zone, and there is no further detection for 20 minutes. The feasibility of this approach should be agreed with the relevant agency and regulator as part of the approval process. It is recognised that the ability to cease operations may be constrained by the substrate type or pile design.

When piling at full power, there is no requirement to cease piling or reduce the power if a marine mammal is detected in the mitigation zone (it is deemed to have entered "voluntarily"[x]). It is also acknowledged that, for engineering reasons, it may not be possible to stop piling at full power until the pile is in final position.

### 2.5 Break in piling activity

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. If a watch has been kept during the piling operation, the MMO or PAM operative should be able to confirm the presence or absence of marine mammals, and it may be possible to commence the soft-start immediately. However, if there has been no watch, the complete pre-piling search and soft-start procedure should be undertaken.

### 2.6 Acoustic Deterrent Devices (ADDs)

The use of devices that have the potential to exclude animals from the piling area should be considered. Acoustic Deterrent Devices (ADDs) should only be used in conjunction with visual and / or acoustic monitoring.

In theory, ADDs have the potential to reduce the risk of causing injury to marine mammals, and are relatively cost effective. However, evidence relating to the efficacy of acoustic deterrents such as "scrammers" or "pingers" is currently limited and there is a need for studies to quantify the efficacy of candidate devices to determine their applicability as suitable mitigation measures.

When planning to use ADDs, the potential effectiveness of candidate devices on the key marine mammal species likely to be present in the area should be assessed as part of the EIA process for the activity. This assessment should feed into the site specific Environmental Management Plan (EMP) or equivalent. It is expected that these devices would always be used in accordance with recommended conditions that would prevent the exposure of animals to disturbance that would constitute an offence under regulations 41 and 39 of the Habitats Regulations and the Offshore Marine Regulations, respectively. It should be noted that a wildlife licence under the

[x] Please note that there is no scientific evidence for this "voluntary" hypothesis, instead it is based on a common sense approach. Note, however, that other factors, such as food availability, may result in marine mammals approaching piling operations. In particular, the availability of prey species stunned by loud underwater noise may attract seals into the vicinity of piling operations.

Wildlife and Countryside Act 1981 (within 12nm) might be required to authorise a potential intentional disturbance.

The use of ADDs will be subject to a number of recommended conditions, for example:

- ADDs should be positioned in the water in close proximity to the pile to be installed; the vessel with the MMOs and PAM operatives may not necessarily be a suitable mooring location for these devices.
- ADDs should be switched on throughout the pre-piling search and turned off immediately after the piling activity has started.

## Section 3 – After the piling activity

### 3.1 Reporting Requirements

Reports detailing the piling activity and marine mammal mitigation, the 'MMO and PAM reports', should be sent to the relevant conservation agency after the end of the piling activity. Reports should include:

- Completed Marine Mammal Reporting Forms
- Date and location of the piling operations
- A record of all occasions when piling occurred, including details of the duration of the pre-piling search and soft-start procedures, and any occasions when piling activity was 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
- Details of any Acoustic Deterrent Devices (ADDs) used, and any relevant observations on their efficacy
- Details of any problems encountered during the piling process including instances of non-compliance with the agreed piling protocol
- Any recommendations for amendment of the protocol

## Section 4 - Variation of standard piling protocol

The above protocol is considered to represent current best practice for a typical windfarm piling operation. Developers may, however, feel that the protocol is unduly restrictive, particularly in respect of restrictions on night-time/low visibility piling. In such cases, the burden of proof lies with the developer to demonstrate that effective mitigation can be delivered using an amended protocol.

A distinction should be made here between piling which commences during times of good visibility (and subject to the above provisions) and continues into a period of poor visibility/ night-time, and piling that commences during times of poor visibility (including night-time conditions).
Assuming that the operations are continuous the first scenario would not need additional mitigation. The second, scenario would, however, require enhanced

mitigation measures. For example, a developer wishing to commence piling at night might need to demonstrate that:

- Such piling is essential for commercial viability.
- The developer will provide enhanced detection of marine mammals (e.g. increased number of PAM systems and PAM operatives for commencement of piling during night-time.

Each request for variations from the protocol should be considered on its merits and, to ensure consistency across projects and other marine industries, in close liaison with JNCC and other statutory nature conservation agencies.

**Section 5 - Securing of mitigation package through legally-binding consent conditions and Environmental Management Plan (EMP)**

Under current arrangements the mitigation package relating to windfarm developments is likely to be secured under FEPA conditions, rather than under the Electricity Act s.36 consent. Conditions drafting is likely to vary according to project specific issues and will evolve as our understanding of the issues improves. Conditions imposed by the MMO (formerly MFA, formerly MCEU Defra) in respect of the Thames windfarms are set out below as an example of possible consent requirements only.

*9.20 Conditions 9.20 to 9.22 shall only apply where driven or drilled pile foundations are to be installed.*

*9.21 Construction activities shall not commence until the Licence Holder has agreed with the Licensing Authority and [insert relevant nature conservation agency name] a scheme for the mitigation of potential impacts on marine mammals. The scheme must be submitted to the Licensing Authority by the date specified in the timetable required under condition 9.35. Such a scheme shall include, inter alia:*

- *A requirement on the Licence Holder to ensure that suitably qualified and experienced Marine Mammal Observers are appointed and [insert relevant nature conservation agency name(s)] notified of their identity and credentials before any construction work commences.*

- *A requirement on the Licence holder must ensure that piling activities do not commence until half an hour has elapsed during which marine mammals have not been detected in or around the site. The monitoring should be undertaken both visually (by Marine Mammal Observers) and acoustically appropriate passive acoustic monitoring equipment. Both the observers and equipment must be deployed at a reasonable time before piling is due to commence.*

- *A requirement on the Licence Holder to ensure that at times of poor visibility (night-time, foggy conditions, sea state greater than that associated with force*

*4 winds, etc.) enhanced acoustic monitoring[xi] of the zone is carried out prior to commencement of relevant construction activity.*

- *A requirement that piling may only commence using an agreed soft start procedure. The duration and nature of this procedure must be discussed and agreed prior to commencement of operations[xii].*
- *A requirement that the Licence Holder must make provision for a reporting methodology to be in place before works commence to enable efficient communication between the MMOs and the skipper of the piling vessel.*

*9.22 Piling activities shall not take place other than in accordance with the scheme agreed at 9.21 above*

In addition to be involved in the drafting of such conditions, it is likely that statutory nature conservation agencies will want to check that a project's Environmental Management Plan contains appropriate protocols relating to the pile driving operations, such as how the MMOs will interact with the piling crew. Drafting of a potential template condition requiring approval of the EMP following consultation with the agencies is set out below:

*X: The Licence Holder must submit a copy of a project Environmental Management Plan for the approval of the Licensing Authority, in consultation with CEFAS, and the [insert relevant nature conservation agency name(s)], at least 4 months prior to the proposed commencement of construction works. To ensure that satisfactory arrangements are in place for liaison on environmental issues. Construction shall not commence until such time as the Environmental Management Plan has been approved by the Licensing Authority.*

*Y: The Licence Holder must ensure that a suitably qualified and experienced liaison officer, Marine Mammals Observer(s) and other officers are appointed (for fisheries and environmental liaison) and that the Licensing Authority is notified of their identity and credentials before any construction work commences, to establish and maintain effective communications between the Licence Holder, contractors, fishermen, conservation groups and other users of the sea during the course of the project.*

*Z: The Licence Holder must ensure that the liaison officer's environmental remit includes:*

*iv) Monitoring compliance with the commitments made in the Environmental Statement and the Environmental Management Plan (as agreed under condition Y above).*

[xi] The details of any enhanced acoustic monitoring scheme would need to be agreed in advance with the regulator as advised by the relevant nature conservation agency however they might include the provision of additional hydrophones and/or T-Pods together with extra PAM operators

[xii] As discussed at footnote 9 above there is potential for "soft-start" levels to be of a sufficient volume to give rise to injury or significant disturbance. Information on possible noise levels will therefore need to be provided as part of the EIA and the process will need to be agreed with the regulator as advised by the relevant nature conservation agency. An excessive level for soft-start procedures might be that capable of giving rise to TTS to an individual in close proximity (metres) to the piling operation

v) *Providing a central point of contact for the Monitoring Programme and Ornithological Monitoring Programmes required under relevant conditions*
vi) *Liaison with fishermen, conservation groups and other users of the sea concerning any amendments to the method statement and site environmental procedures.*
vii) *Inducting site personnel on site / works environmental policy and procedures.*

## Section 6 - References

Collaborative Offshore Wind Research into the Environment (COWRIE): http://www.offshorewindfarms.co.uk

JNCC, Marine Advice,
Inverdee House, Baxter Street
Aberdeen, AB11 9QA,
United Kingdom
Tel: +44(0)1224 266550
Email: seismic@jncc.gov.uk

# ANNEX C - JNCC guidelines for minimising the risk of injury to marine mammals from using explosives

June 2010

## Introduction

These guidelines have been written for activities on the United Kingdom Continental Shelf (UKCS), and are aimed at reducing the risk of injury to negligible levels and potentially reduce the risk of disturbance from explosive activities to marine mammals including seals, whales, dolphins and porpoises.

The use of explosives in the marine environment ranges from inshore activities such as harbour construction to offshore operations such as wellhead or platform decommissioning, and includes research, commercial and military activities, all of which have the potential to impact upon marine mammals.

The Conservation of Habitats and Species Regulations 2010 (the 'Habitat Regulations, HR) for England and Wales and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (the 'Offshore Marine Regulations', OMR, as amended in 2009 and 2010) make it an offence to deliberately kill, injure or disturb marine European Protected Species (EPS, which includes all cetaceans and turtles in UK waters), and it is recognised that underwater explosions have the potential to cause injury or death to these animals. It is considered that adherence to the recommendations in these guidelines will reduce the risk of causing an offence to negligible levels.

**Please note that the mitigation measures recommended in the existing guidelines are more relevant to the prevention of injury rather than disturbance as defined in regulations 41(1)(2) and 39(1A). However, for activities that make use of explosions for a relatively short period of time, it is considered that there would be a low likelihood of disturbance occurring that would constitute an offence under the HR and OMR. Nevertheless, the onus should be on the entity responsible for the activity to assess whether a disturbance offence is likely to occur. Guidance on how to carry out such risk assessment is provided in the JNCC, NE and CCW document 'The protection of marine European Protected Species from injury and disturbance'.**

JNCC notes that other protected fauna, for example turtles, will occur in waters where these guidelines may be used, and would suggest that, whilst the appropriate

mitigation may require further investigation, the protocols recommended for marine mammals would also be appropriate for marine turtles and basking sharks[i]

The JNCC explosive guidelines reflect current best practice for operators to follow during the planning, operational and reporting stages. As the scale of explosive use will vary for each operation, it is recommended that the generic guidance provided below is customised and incorporated into an Environmental Management Plan (EMP), detailing the actions and responsibilities for a specific activity. Ideally, this EMP should be attached to any applications for relevant consents.

**Index**



**Terminology**

**Marine European Protected Species:** These are marine species in Annex IV(a) of the Habitats Directive that occur naturally in the waters of the United Kingdom. These consist of several species of cetaceans (whales, dolphins and porpoises), turtles, and the Atlantic Sturgeon.

**Marine Mammal Observer (MMO)**: Individual responsible for conducting visual watches for marine mammals. It may be requested that observers are trained, dedicated and/or experienced. The MMO may also be a PAM operative.

- **Trained MMO**: Has been on a JNCC recognised course
- **Dedicated MMO**: Trained observer whose role on board is to conduct visual watches for marine mammals (although it could double up as a PAM operative)
- **Experienced MMO**: Trained observer with 3 years of field experience observing for marine mammals, and practical experience of implementing the JNCC guidelines

[i] Basking sharks are protected from intentional capture or disturbance in British waters (up to 12 miles offshore) under a 1998 listing on the Wildlife and Countryside Act (1981), Schedule 5.

- **PAM Operative**: Person experienced in the use of PAM software and hardware and marine mammal acoustics

**Mitigation Zone**: The area where a Marine Mammal Observer keeps watch for marine mammals (and delays the start of activity should any marine mammals be detected). In instances where there is uncertainty about the extent of the mitigation zone, it is recommended that the default mitigation zone should have a radius of 1 kilometre.

**Passive Acoustic Monitoring (PAM)**: Software system that utilises hydrophones to detect the vocalisations of marine mammals.

## Section 1 - The Planning Stage

When the use of explosives is planned, the body responsible for undertaking the proposed activity should:

- Determine what marine mammal species are likely to be present in the survey area and assess if there are any seasonal considerations that need to be taken into account, including for example periods of migration, breeding, calving or pupping. For UKCS activities the 'Atlas of cetacean distribution in north-west European waters' (Reid, *et al* 2003) is a useful starting point.
- As part of the environmental impact assessment, assess the likelihood of injuring or disturbing a European Protected Species. In the UK, it will be necessary to assess the likelihood of committing an offence as defined in the HR and in the OMR.
- Consult the JNCC, NE and CCW guidance on '*The protection of marine European Protected Species from injury and disturbance*' to assist in the environmental impact assessment (www.jncc.gov.uk/page-4226).
- Determine the distance at which the explosive detonations could cause physical injury to marine mammals. This should enable the operator to establish a suitable mitigation zone, the area where mitigation measures must be in place to ensure that injury is avoided.
- The default mitigation zone for marine mammal observation mitigation should be 1 kilometre, measured from the explosive source and with a circular coverage of 360 degrees.
- The radius of the mitigation zone may be reduced, or increased, from the default 1-kilometre if evidence supporting this change is accepted by the regulators following consultation with the appropriate nature conservation agency.

- Assess the available mitigation measures that can be put in place to minimise the risk of causing an offence, which should include the following:

    - Only commence explosive detonations during the hours of daylight and good visibility (observers should be able to monitor the full extent of the mitigation zone). Plan explosive detonations so that the scheduling will reduce the likelihood of encounters with marine mammals. For example this might be an important consideration in certain areas/times, e.g. during seal pupping periods near Special Areas of Conservation for common seals or grey seals

- Seek to provide trained Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) operatives to implement the requirements of these guidelines (section 2.1 – 2.4).
- Accurately determine the amount of explosive required for the operation, so that the amount is proportionate to the activity and not excessive.
- Plan the sequence of multiple explosive charges so that, wherever possible, the smaller charges are detonated first to maximise the 'soft-start' or 'ramp up' effect.
- Consider the use of acoustic mitigation devices that could be deployed and left at the detonation site before any explosions are undertaken. The relevant nature conservation agency will be able to advise on the suitability of Acoustic Deterrent Devices (ADDs) on a case by case basis (section 2.6).

## Section 2 - At the time of operation

Visual and / or Passive Acoustic Monitoring (PAM) should be provided throughout the operation. The flowchart in figure 1 illustrates the key decision making stages, which include the pre-detonation search (section 2.3) conducted by Marine Mammal Observers (MMOs) and PAM operatives and the requirement to delay the detonation (section 2.4) if any marine mammals are detected within the mitigation zone. After any break in detonation, or the end of the detonation sequence, a post-detonation search is carried out (section 2.6).

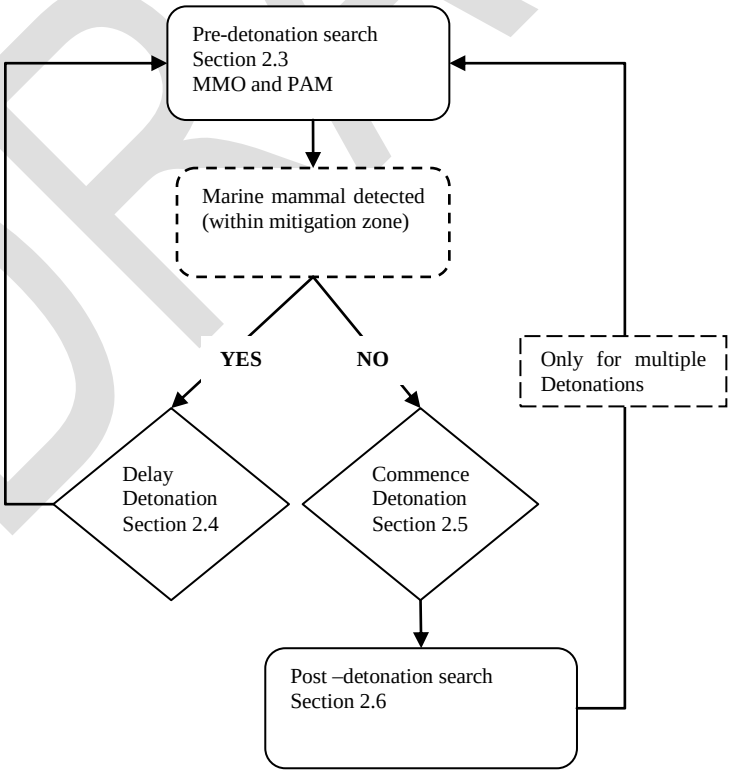



Figure 1. Decision making flowchart for an MMO. If any marine mammals have been detected during the pre-detonation search a delay to the detonation sequence is recommended. After a break in explosive use a post-detonation search is conducted.

## 2.1 Visual Monitoring by Marine Mammal Observers

- The use of dedicated and trained Marine Mammal Observers (MMOs) is recommended.
- The MMO(s) should be onboard the vessel that provides the best viewing platform and is likely to be closest to the explosive activities.
- Visual monitoring for marine mammals should be carried out from a suitable platform such as the ships bridge that allows 360 degree cover
- Depending upon the size of the mitigation zone (figure 2), more than one MMO viewing platform (and therefore more than one vessel) may be required to ensure that the entire mitigation zone can be observed.
- The MMO(s) should concentrate their efforts before, during and after detonation.
- The MMO(s) should be suitably equipped with binoculars and Marine Mammal Reporting forms, and be capable of determining the extent of the mitigation zone in relation to their viewing platform.

All MMO forms, including a guide to completing the forms, and instructions on how to make and use a range finding stick are available on the JNCC website.

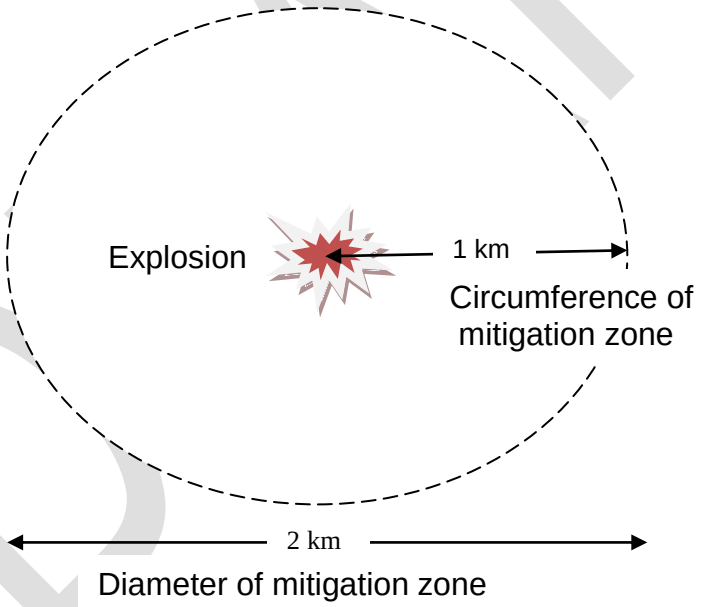



Figure 2: A representation of the mitigation zone, this is measured from the location of the explosive source out to a distance of 1 kilometre. The MMO will be required to move away from the detonation to a safe 'stand-off' distance before the detonation commences.

## 2.2 Passive Acoustic Monitoring (PAM)

Visual observation is an ineffective mitigation measure during periods of darkness or poor visibility (such as fog), or during periods when the sea state is not conducive to visual mitigation, as marine mammals in the vicinity of explosive sources will not be

detected. JNCC views PAM as the only available mitigation technique that can be used under these conditions, and that it can also be used to enhance the detection of certain marine mammal species.

PAM systems consist of hydrophones that are deployed into the water column, and the detected sounds are processed using specialised software. PAM operatives are needed to set up and deploy the equipment and interpret the detected sounds.

The PAM hydrophones should be situated as close as possible to the site of detonation, and sacrificial hydrophones may therefore be required. Hydrophones deployed from standby vessels can be used for acoustic monitoring, but a disadvantage of these systems is that they will move away from the site of detonation when the vessel moves to the 'stand off' position prior to the detonation, and may then be too far away to detect any marine mammal vocalisations within the mitigation zone.

Remotely operated static PAM systems, which can be left at the detonation site, may be an option (e.g. for well abandonment campaigns), but they may not always be commercially available, or best suited for operations in shallow coastal environments.

### 2.2.1 Use of PAM as mitigation tool

PAM can provide a useful supplement to visual observations undertaken by MMOs. However, in many cases it is not as accurate as visual observation for determining range, and this will mean that the mitigation zone will reflect the range accuracy of the system. For example, if the range accuracy of a system is estimated to be at +/- 300 metres, animals detected and calculated to be within 800 metres of the detonation could, in reality, be 800 + 300 = 1100 metres from the detonation, but their detection would still lead to a delay in the soft-start. Although at present it is not possible to express the range accuracy of most PAM systems in numerical terms, this example serves to illustrate that it is always appropriate to use the most accurate system available, and for the PAM operative to factor in a realistic estimate of the range accuracy.

Some PAM systems do not have a reliable range determination facility or can only calculate the range for some species. In such cases, the detection of a confirmed cetacean vocalisation should still be used to initiate postponement of the soft-start if the PAM operator is able to make a judgement about the range of the marine mammal (dependent on species) from the detonation, because of experience gained in differentiating between distant and close vocalisations. In the absence of PAM systems capable of range determination, this expert judgement will constitute the basis for deciding whether an area is free from cetaceans prior to the soft-start.

## 2.3 Pre-detonation search for marine mammals

At least 1 hour before any type of detonation, a visual watch and, if required, acoustic monitoring, known as the 'pre-detonation search', should be carried out in the mitigation zone. The pre-detonation search should continue until the MMO advises that the mitigation zone is clear of marine mammals, and the detonation can start.

## 2.4 Delay if marine mammals detected within the mitigation zone

- Explosive detonations should not be undertaken within 20 minutes of a marine mammal being detected within the mitigation zone.
- If a marine mammal is observed, or acoustically detected, within the mitigation zone, it should be monitored and tracked until it moves out of range. The MMO should notify the relevant chain of command of the detection, and advise that the operation should be delayed. If the marine mammal is not detected again within 20 minutes, it can be assumed that it has left the area and the detonation may commence.
- If an animal has been detected acoustically, the PAM operative should use a range indication and their judgement to determine whether the marine mammal is within the mitigation zone.
- If an MMO or PAM operative is uncertain whether marine mammals are present within the mitigation zone, they should advise that the activity should be delayed as a precaution until they are certain that no animals are present.

## 2.5 Sequencing of the explosive charges

Whenever possible, the order in which the explosive charges are detonated should be controlled, with the aim of reducing the environmental impact. A progressive increase in charge size (generally referred to as 'soft-start' or 'ramp up') may be effective as a means of reducing the risk of injury, by allowing time for marine mammals to move away from the area.

Where practical, the sequence of detonations should start with the smaller charges and leave the larger charges until last. Where the work scope dictates that groups of charges must be detonated together, consideration should be given to appropriate fusing to fractionally delay the detonation of the second and subsequent charges (only by milliseconds), thus reducing the cumulative effect of the charges and lessening the impact of the shock wave.

## 2.6 Acoustic Deterrent Devices (ADDs)

The use of devices that have the potential to exclude animals from the mitigation zone should be considered. Acoustic Deterrent Devices (ADDs) should only be used in conjunction with visual and / or acoustic monitoring and for as short period as necessary to minimise the introduction of additional noise.

In theory, ADDs have the potential to reduce the risk of causing injury to marine mammals and are relatively cost effective. However, evidence relating to the efficacy of acoustic deterrents such as "scrammers" or "pingers" is currently limited, and there is a need for studies to quantify the efficacy of candidate devices to determine their applicability as suitable mitigation measures.

When planning to use ADDs, the potential effectiveness of candidate devices on the key marine mammal species likely to be present in the area should be assessed as part of the EIA process for the activity. This assessment should feed into the site specific Environmental Management Plan (EMP) or equivalent. It is expected that these devices would always be used in accordance with recommended conditions

that would prevent the exposure of animals to disturbance that would constitute an offence under regulations 41 and 39 of the Habitat Regulations and the Offshore Marine Regulations, respectively. However, it should be noted that a wildlife licence under the Wildlife and Countryside Act 1981 (within 12 nm) might be required to authorise a potential intentional disturbance.

The use of ADDs will be subject to a number of recommended conditions, for example:

- ADDs should be positioned in the water in close proximity to the explosive source installed; the vessel with the MMOs and PAM operatives may not be a suitable mooring location for these devices.
- ADDs should be switched on for a pre-determined number of emissions during the pre-detonation search and turned off immediately once the detonations have commenced.

2.7 Post-detonation search

The MMO should maintain a post-detonation search within the mitigation zone for at least 15 minutes after the last detonation, to look for any evidence of injury to marine life, including fish kills. Any unusual observations should be noted in the report.

2.8 Communication

It is vital that clear communication channels exist between MMO(s) / PAM operators and personnel detonating the explosives. As each explosive use is likely to be different, it is recommended that communication channels should be established and in place before the activity commences, and ideally these matters should be discussed and agreed at a pre-mobilisation meeting. For example, the MMO or PAM operator might communicate directly with the engineers detonating the explosives, or via another member of the crew.

## Section 3 - Reporting

Reports detailing the marine mammal mitigation activities, the 'MMO and PAM reports' should be sent to the JNCC, after the explosives operation has been completed. Ideally the reports should be sent by e-mail to **seismic@jncc.gov.uk**, or they can be posted to the address on the front page of these guidelines. Reports should include:

Important information to record in the MMO report:

- Where relevant, the reference number for the activity provided by the regulatory authority.
- Date and location of the activity.
- Details of the proposed operation, including: information on the size of charges used; the start times of explosive detonations; the start and end times of watches by MMOs; the start and end times of any acoustic monitoring using PAM; and details of all explosive activity during the relevant watches.

- Any marine mammal sightings, summarised in completed 'Marine Mammal Recording Forms'. Although these have been developed for the seismic industry they can be used for other applications, such as explosive use. The form is an EXCEL spreadsheet that has embedded worksheets named 'Cover Page', 'Operations', 'Effort' and 'Sightings'. 'Deckforms' are also available, and MMOs may prefer to use this when observing before transferring the details to the Excel spreadsheets. All the forms and guidance for their completion are available on the JNCC website at http://www.jncc.gov.uk/page-1534
- Details of any Acoustic Deterrent Devices used, and any relevant observations on their efficacy.
- Details of any problems encountered during the activity, including instances of non-compliance with the JNCC guidelines and any variations from the agreed procedure.

## Section 4 - Background information and applicable legislation

### 4.1 Existing protection to cetaceans

Section 9 of the Wildlife and Countryside Act 1981 (CRoW amended) prohibits the intentional or reckless killing, injuring or disturbance of any cetacean. The UK is a also a signatory to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), and has applied its provisions in all UK waters. Amongst other actions required to conserve and manage populations of small cetaceans, ASCOBANS requires range states to "work towards...the prevention of ...disturbance, especially of an acoustic nature".

Reflecting the requirements of the Convention on the Conservation of European Wildlife and Habitats (the Bern Convention) and Article 12 of the EC Habitats and Species Directive (92/43/EEC). The UK has the following legislation in place:

- The Conservation of Habitats and Species Regulations 2010
- The Conservation (Natural Habitats, etc.) Regulations 1995 (Northern Ireland) (and 2009 amendments)
- The Conservation (Natural Habitats, &c.) Amendment (No. 2) Regulations 2008 (Scotland) (and 2009 amendments)
- The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (and 2007 Amendments),
- The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (and 2009 and 2010 amendments) (Beyond 12 nautical miles UKCS)