JOINT NATURE CONSERVATION COMMITTEE

The deliberate disturbance of marine European Protected Species

Guidance for English and Welsh territorial waters and the UK offshore marine area

By

JNCC

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3. The Activities

In order to assess the risk of committing a disturbance offence, the characteristics of the proposed activity and the associated potential disturbance factors need to be taken into account, in addition to species related information (in previous section). Please bear in mind that where actions may result in other offences being committed, such as the **killing**, **injuring** or **taking** of a marine EPS, it will necessary to consider how these offences can also be avoided and whether a wildlife licence is required

3.1. Factors with the potential to cause disturbance to marine EPS
The main factors with the potential to cause disturbance to marine EPS are:

a) anthropogenic sound; and
b) physical obstruction, including collision.

Apart from direct effects, these factors also have the potential to cause secondary effects such as changes in habitat (e.g. loss of feeding areas) and/or reduction in food availability.

The consequences of any of these factors in terms of the potential to cause 'significant disturbance' (i.e. disturbance constituting an offence under regulations 39(1)(b) of the HR or OMR) will greatly depend on the temporal and spatial characteristics of the activity (e.g. prevalence). In addition, it will be very difficult to prove a cause and effect link due to the uncertainty related to the long-term effects of these factors and to the natural variability inherent to marine EPS populations. As a result, efforts should focus on avoiding disturbance first and then applying mitigation and following and enforcing good practice guidelines.

The adoption of good practice guidelines will minimise the risk of committing an offence (see Appendix II). If, despite all precautions, significant disturbance does unexpectedly occur then the preventative and precautionary actions that have been taken will be relevant to the question of whether the action was 'deliberate' (see section 1.3. for a definition). However, it must be recognised that, if the disturbance caused by the activity (even when using mitigation) is likely to be detrimental to the maintenance of the populations of the species concerned at a Favourable Conservation Status (FCS, see Appendix III for a definition) in their natural range (regulations 44(3) and 49(7), respectively), the activity cannot be undertaken, and will not be eligible for licensing. Those considering undertaking activities that may disturb EPS should seek their own legal advice.

3.2. Characteristics of the activity in relation to factors with the potential to cause disturbance
In order to assess the likelihood that an activity may adversely affect a significant group of animals (see sections 1.3. and 2.2.) or significantly affect the local distribution or abundance of a marine EPS (see sections 1.3. and 2.3.), the following activity-specific criteria should be considered:

- Factors with the potential to cause disturbance (sound, obstruction) and likely impacts during all stages of the activity;
- Scale of the activity, i.e. intensity (e.g. sound) and extent (e.g. how large is the area potentially affected, including areas beyond the site where the activity is taking place);

- Prevalence of potential disturbance factors, i.e. duration and frequency of the activity (taking into consideration any factor that prevails beyond the time frame of the activity itself);
- Timing of the activity in relation to species-specific temporal patterns of abundance (e.g. seasonal / tidal changes) in the potential area of impact (see 3.2.1.);
- Mitigation measures to be put in place and their potential to reduce the risk of disturbance.
- In the context of their natural range, consideration should be given to the interaction with other ongoing, potentially disturbing activities that could affect the species/populations; and
- In the local context, consideration should be given to the interaction with other ongoing, potentially disturbing activities present in the area during the same period of time.

The following activities may involve one or more factors of potential disturbance (letters following the activity correspond to either of the two factors listed in 4.1.):

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

Note that if disturbance occurs during actions that were for the purpose, and in the course of, '**sea fishing**', the defendant shall not be taken deliberately to have caused 'significant disturbance' where he did not intend that disturbance to occur and had taken reasonable steps to comply with requirements of relevant Community instruments (see HR Regulations 39(14) to (16), OMR Regulations 39(9) to (11)). All activities related to sea fishing are regulated within the framework of the Common Fisheries Policy.

In the next sections, a brief description is given of the activities with the potential to cause disturbance to cetaceans, together with some information, where available, on the spatio-temporal extent of the activity. The main concerns regarding impacts on cetaceans and any evidence to support this are highlighted together with a review of gaps in 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 which entities are working on them. These guidelines can either be found in annexes to this document or by following the links provided.

3.2.1. Acoustic deterrent (and harassment) devices (the use of)
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 dangers or 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 (<180db rms re 1µPa at 1m) used on fishing nets to prevent entanglement, while AHDs (or seal scarers) produce high power sounds (>180db rms re 1µPa at 1m) and are usually used more permanently to prevent seals from getting close to fish farm pens[1; 2]. Acoustic mitigation devices (AMDs) is the broad term used for any underwater high-frequency sound emitting device intended to exclude marine mammals from areas of exposure to high-intensity noise such as pile driving[2] or as alerting signs to whales to prevent ship strikes[3].

The use of AHDs in fish farms to scare away seals has increased in frequency in the last decade. There are concerns about the effects of these devices on other species that frequent the area and might be sensitive to the sound produced, particularly cetaceans. The potential for effects will depend on the behaviour of the animals at the time, but also on the source level and spectrum of the device. Effects could range from the sound of the device just being audible (in areas far away from the device) to hearing injury at closer ranges (introducing the risk of another offence), with a zone of disturbance somewhere in between. Taylor et al (1997)[4] predicted that the zone of severe discomfort for harbour porpoises to a particular AHD would occur where the received sound pressure level was equal to or greater than 130 dB re 1 µPa.

It is likely that the animals will react to the sound source by moving away from the area. There is evidence that some species can be displaced from areas where these devices are being used. A decline of killer whale sightings coincident in time and space with the installation of several high amplitude AHDs in salmon farms in a region of Canada was observed when compared with a nearby area where no AHDs were in use, and where killer whale sightings have been stable over the same period [5]. This study provided evidence of the abandonment of a specific portion of the whale's important habitat, an effect that is considered likely to constitute an offence under the HR and/or OMR. Nevertheless, the whales returned to the area when the AHD stopped being used, after 5 years of use. The effects of one type of these devices have also been tested experimentally on harbour porpoises and seem to result in 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, with animals completely excluded from an area within 200-600m of the AHDs[6;7].

Whilst there is the potential to use AHDs as AMDs in order to exclude cetaceans from an area of high intensity noise, evidence on their efficacy for this purpose is still limited. Work commissioned by COWRIE, the offshore windfarm industry research group, has concluded that 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"). Because of the uncertainties surrounding their use (efficacy, species-specific application, disturbance, and habituation) and the limited ranges of the mitigation zone provided by these devices, their use cannot reliably ensure that marine mammals are clear of the area affected by the high intensity noise, prior to an activity commencing. Some modifications to these devices, e.g. varying frequency of the sound produced, show some promise in reducing habituation of the target species to the stimulus[1]. Currently, however, these devices do not provide an alternative to the risk minimisation procedures used in marine construction related operations (see for example Annex B). Additionally, it is considered that their use could constitute disturbance and could eventually reach the thresholds of "significant disturbance" under regulation 39(1)(b), and therefore constitute an offence if unlicensed under regulation 44 of the HR and/or OMR.

The potential effect of these types of devices on cetaceans is an active area of investigation. The Scottish Aquaculture Research Forum has commissioned research on the potential effects of these devices on cetaceans and on their effectiveness as a predator control method. It is hoped that the output of this project will help to develop recommendations of best practice for acoustic device use and compliance with national and international nature conservation requirements.

In the UK, currently, there are no good practice guidelines for maximising efficiency of any of these devices whilst mitigating for impacts on cetaceans. Nevertheless, some commonsense measures can be applied, such as using these devices for as short a period as necessary. SNH is also planning on updating the "Salmon Farming and Predatory Wildlife - a code of practice" which will include advice on the use of anti-predator devices such as ADDs.

3.2.2. Aggregate extraction

Marine aggregate extraction in the UK has become more common in the latter part of the 20th century, following a general decline in accessible land-won material, and demand 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 from offshore dredge sites direct to wharves located close to the point of use. The dredge areas are licensed from the Crown Estate following an extensive Environmental Impact Assessment (EIA) and stakeholder consultation process regulated through the Marine and Fisheries Agency (MFA) Marine Environment Team. Licences are issued for 15 years with a review every 5 years. In 2006, the total area of sea bed licensed for marine aggregate extraction was 1,316 km^2, comprising about 70 production licence areas[8]. The total area actually dredged was 141 km^2 and, of this, 90% of dredging effort took place within 49 km^2. Marine aggregates are currently extracted from waters off the English and Welsh coasts. Currently there is no marine aggregate dredging in Northern Ireland waters.

Concerns relating to impacts of this activity on marine EPS refer to those that could potentially arise from the noise generated by large vessels associated with dredging, prey reduction (through removal of benthic prey to fish) and by increased turbidity. In reality, the likelihood of these impacts causing a disturbance offence is very low, since the area affected is small and cetaceans are highly mobile. There are "Guidelines on the impact of aggregate extraction on European marine sites"[9], which discuss very briefly potential impacts of dredging activities on marine mammals.

Dredging operations (including associated vessels) are 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[10]. Studies have indicated the possibility of behavioural impacts on cetaceans, in some cases with animals leaving an area where dredging was taking place, and in others, becoming habituated to the sound. The sensitivity of fish (and also marine mammals) to the noise associated with dredging operations has been discussed in in the CEFAS report '[Preliminary investigation of the sensitivity of fish to sound generated by aggregate dredging and marine construction]'. One of the current aims of the MALSF (Marine Aggregate Levy Sustainability Fund) is to 'increase understanding of the effects of aggregate dredging activities, including noise, and their significance'.

As part of the Environmental Impact Assessment process for marine aggregate extraction, the applicant should always consider the likelihood of marine EPS occurring in the area affected and the potential impacts of the activity on these species, including the likelihood of committing a disturbance offence as per the guidance in the present document. The JNCC also recommends the use of "Marine aggregate extraction: approaching good practice in environmental impact assessment" during an EIA.

There are no specific good practice guidelines on how to mitigate disturbance of marine EPS during this activity since the potential for impacts and its significance are considered to be low. Mitigation measures associated with this activity are mostly aimed at reducing the impacts on the seabed and associated benthos and the effects of suspended sediment concentrations.

3.2.3. Aircraft noise

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 but this is not known to occur in UK waters. Low flying aircraft and helicopters have the potential to disturb marine EPS while these 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. Short-term behavioural responses have been observed for bowhead whales and beluga whales to a helicopter and fixed-wing aircraft flying at low altitudes of around 50m[11]. The effects of aircraft noise will be restricted to a brief shallow 'footprint' directly below the aircraft and it is considered that this is unlikely to cause disturbance that would be significant in the terms of the Regulations. However, in areas of persistent and intense use by low flying aircraft (e.g. near military bases or in areas of high density of oil and gas platforms), and if these overlap with areas where populations of species that show some site-fidelity (e.g. coastal bottlenose dolphin), hence more vulnerable to chronic exposure, an assessment of the likelihood of committing a disturbance offence, should be carried out. A limit to the flying altitude could be put in place in areas of concern. There is a lack of understanding of the potential cumulative effects that the intense traffic of low flying aircraft in a particular area could have on cetacean populations. Currently, no good practice guidelines relating to mitigation of the impacts of aircraft noise on marine EPS exist in the UK.

3.2.4. Construction works (including pile driving, rock dumping, cable and pipe laying)

Construction works in or near the sea such as those involved in building harbours and marinas, offshore oil industry facilities, offshore windfarms, etc may involve the use of pile driving, rock dumping, and cable or pipe laying. In a few cases, explosives may be used underwater (see section 3.2.9).

In addition to effects arising from the deposit of materials, such as loss of habitat, construction activities may create high intensity underwater sounds. MFA's Marine

Environment Team licenses the following marine construction works involving deposits of materials on the seabed: new harbours and marinas, marine structures / piers, outfalls pontoons and jetties, offshore windfarms / energy facilities, land reclamation, flood defences sea walls, coastal protection work, cables (where not exempted) and pipelines (excluding those associated with oil and gas). The majority of applications dealt with are in relation to the Food and Environment Protection Act 1985 (FEPA) licences and Coast Protection Act (CPA) 1949 consents. In order to obtain a licence it may be necessary to carry out an EIA. Guidance on EIAs for FEPA is available from Defra.

In addition to FEPA licences, the construction of offshore windfarms requires other consents, most notably from the Department for Business, Enterprise and Regulatory Reform (BERR) under s.36 Electricity Act 1989. Additional guidance on windfarm EIA is available from CEFAS. 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 wind in the UK are currently undergoing Strategic Environmental Assessment.

As discussed [above], oil and gas construction works are consented solely by BERR under a different regulatory regime.

Pile driving

Pile driving is where a pile is driven into the sea-bed using a hydraulic hammer. This is associated with many offshore construction activities, most notably in oil and gas developments and in the construction of offshore wind farms. Harbour development, bridges and the installation of navigational aids can also involve the driving of piles.

Pile driving may result in substantial levels of underwater noise being generated. 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, seabed conditions, and physical factors that will influence sound propagation, such as water depth, bathymetry, and salinity. Low frequency sounds dominate pile driving, and these tend to attenuate more rapidly in relatively shallow water than in deeper waters, i.e. these sounds do not travel as far in shallow water. Pile driving is a static activity that may take place for short periods of time but, for some constructions, many piles are required. For example, in 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 exposure of animals that show some site fidelity to the area affected.

The installation of driven piles in the marine environment without mitigation is likely to produce noise levels capable of inducing adverse avoidance reactions, injuries (e.g. physical damage or hearing impairment) or even death in marine mammals, if in very close proximity[v]. Additionally, behavioural effects may also occur (for example aversion reactions

[v] 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

or displacement), and longer-term, population level impacts of the disturbance caused by pile driving over an extended period[12]cannot be discounted. Impacts on fish and shellfish, including on spawning processes, may also arise[13].

There is a wide range in pile sizes and lengths, and in the duration of piling, and hence in the potential for disturbance, depending on the type of construction and substrate. The assessment of the likelihood to cause disturbance should always be carried out on an individual project basis and mitigation put in place appropriately. This could range from simply having a member of the ship's crew making sure the area is clear of cetaceans before starting the piling, to comprehensive mitigation. Mitigation should be (and is usually) included in the project proposal by the developer, and further developed as part of the EIA process.

The MFA has adopted a standard FEPA licence condition for the use of soft start (where the hammer energy is gradually increased), marine mammal observers (MMOs) and passive acoustic monitoring (PAM), in mitigating the impacts of pile driving associated with the installation of 'Round 2' offshore wind farms. In such cases, MMOs and PAM would be used for the detection of marine mammals, basking sharks and turtles within a monitoring zone and appropriate protocols would specify how construction activities should take place. For example, a licence condition might stipulate that piling activities should not commence until half an hour has elapsed during which marine mammals have not been detected in or around the monitoring zone. It should be noted that additional measures would probably be required in areas where environmental impact assessment suggests that high cetacean densities or site-fidelity may occur.

A guidance note on the implications of the EC Wild Birds and Habitats Directives for developers undertaking offshore windfarm developments has been issued by Defra in March 2005 (http://www.defra.gov.uk/wildlife-countryside/ewd/windfarms/windfarmguidance.pdf).

For piling associated with the offshore oil and gas industry, an assessment of the potential impacts of piling operations should be included within the EIA. An EIA is necessary under the terms of the Offshore Petroleum Production and Pipe-lines (Assessment of Environmental Effects) Regulations 19989 and amendments 2007. BERR are responsible for all consents related to this industry and guidance is available on the BERR website (http://www.og.berr.gov.uk/environment/opppr.htm). As part of the EIA process each applicant should describe the potential impacts and the proposed mitigation to minimise these. The EIA may be in the form of a Petroleum Operations Notices (PON) or a full Environmental Statement. A list of all PONs is available on the BERR website.

A draft protocol for mitigation of wind farm piling noise at sea is provided in Annex A.

Rock dumping

Rock dumping can be used for example for burying and stabilising pipelines or as scour protection on the seabed or in connection with marine construction works such as the building of a harbour. For activities other than those associated with the oil and gas industry, a FEPA application and (if applicable) an associated EIA would be submitted to MFA (as described above). For rock dumping associated with oil and gas activities, the assessment of the potential impacts of rock dumping would be included as part of the existing EIA procedures.

The permanent placing or deposition of most materials such as gravel, rock, mattresses or protective pipeline covers on the seabed during the construction of a pipeline is governed by the Pipeline Works Authorisation Regulations (PWA) under the Petroleum Act 1998: Offshore Pipelines. No data are available on what the noise levels generated by rock dumping might be, however this will typically be of short-duration, and has low likelihood of a potential impact on cetaceans from the generation of noise.

Cable and pipe laying
Cable and pipe laying include the laying on the seabed of electrical, telecommunication, and fibre optic cables, as well as pipelines associated with the oil and gas industry or sewage outfalls. For activities other than those associated with oil and gas and telecommunication cables, a FEPA application and (if applicable) an associated EIA would be submitted to MFA (as described above). For cable and pipe laying associated with oil and gas activities, the assessment of the potential impacts would be included as part of the existing EIA procedures, under the Offshore Petroleum Regulations. The installation of pipelines and cables and associated rock dumping is consented under the Pipeline Works Authorisation Regulations. Little noise is generated from the laying of cables and pipes, but rock dumping will generate noise (see above).

3.2.5. Decommissioning, including well abandonment
When offshore installations (however small or large) reach the end of their useful life, and with agreement from the UK Government, a decommissioning plan will be produced by the operator as to how the installation will be removed from the seabed. This could involve cutting of the structure using a variety of tools or the use of explosives. Non-explosive cutting technology produces relatively little noise production, while explosive use can potentially cause disturbance, injury and even death to a cetacean (see section 3.2.9 on explosive use). Advances in cutting technology have reduced the overall use of explosives in recent years. However, there are still a large number of suspended well heads and production structures that will need decommissioning. All decommissioning activities tend to occur over a limited period of time.

The assessment of the likelihood to cause disturbance should always be carried out within the decommissioning plan and its 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 explosions, to more sophisticated mitigation strategies.

Offshore renewables (windfarms and tidal and wave power) also need to consider the impact on marine EPS of the decommissioning stage. Developers are required to submit a decommissioning plan under s.105 Energy Act 2004, which should be supported by an EIA.

3.2.6. Drilling
Drilling is mostly used in oil and gas exploration, although it can be used as part of other offshore constructions or to drill boreholes. In the oil and gas industry, drilling can be used for exploration and appraisal. This will usually be carried out from mobile drilling units, jack-up rigs, semi-submersibles or drill ships. These platforms may be positioned using anchors or dynamic positioning systems (except jack-ups). Production drilling, including well maintenance will often be carried out from a fixed offshore platform if situated over the reservoir, if not, these activities will use mobile drilling units. Drilling involves not only the

drilling facility itself but a series of activities such as aircraft and vessel support, all adding up to a noise signature around the area of drilling. In particular, the use of dynamic positioning systems should be considered within EIAs since these are sources of constant noise. Drilling noise is generally of low concern to cetaceans[10] but the noise levels depend on the type of drilling facility employed. The temporal scale of this activity varies but usually it is in the range of two or three weeks to three to four months. The pattern of drilling sound production by the oil and gas industry will be for 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[10].

No good practice guidelines exist in the UK for drilling activities since these are thought to be of low concern in terms of disturbance to cetaceans. However, the scale of the drilling operations can vary, and therefore the assessment of the likelihood to cause disturbance should always be carried out and mitigation put in place if appropriate. Noise production on platforms is minimised as a matter of course when personnel are likely to be impacted under Health & Safety at work legislation.

3.2.7. Electromagnetic surveys

Controlled Source Electromagnetic Imaging (CSEM) is a sounding technique, increasingly used by oil exploration companies to provide information on the likely presence of hydrocarbons in geological structures mapped from seismic data. It uses a horizontal electric dipole (HED) which emits a low frequency continuous electromagnetic signal with a frequency within the range of 0.1 to 1 Hz. Not much is known about the potential effects of this technique on cetaceans. The electric and magnetic fields produced by the transmitter are of more concern to animals that are sensitive to these signals (such as sharks and rays). These surveys are typically of short-duration and the area affected is likely to be highly localised around the source, at 30m above the seabed. No guidelines exist on good practice during the use of this technique.

3.2.8. Explosive use

Explosives are used in the course of several activities, for example, during the decommissioning of offshore oil and gas facilities in order to remove infrastructures from the seabed. Pressure pulses from explosions have higher peak levels than those from any other man-made source, and very rapid rise times[10]. At close distances, explosives also produce shock waves, which propagate in a different manner than acoustical energy. Underwater explosions have the potential to cause disturbance, injury or even death to cetaceans. 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[14] (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.

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 if suitable mitigation was in place. 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. In addition, for activities in which the use of explosives will occur over a prolonged period, it is considered that there is a high likelihood of such disturbance occurring and the developer should consider mitigation measures that would address not only the risk of death and injury but also of disturbance.

The JNCC has produced “Draft guidelines for minimising acoustic disturbance to marine mammals from explosive use” (see Annex B). Operators wanting to use explosives in the marine environment should adopt these generic guidelines, making any necessary adaptations and include them as mitigation measures. This is often known as a site-specific Environmental Protection Plan (EPP). This EPP may be included in the decommissioning plan under the Petroleum Act 1998. Guidance on decommissioning activities associated with oil and gas can be found on the BERR website.

3.2.9. Maintenance of navigation channels (including dredging and dumping)

Maintenance dredging is necessary to maintain safe navigation depths at harbours and marinas. Main concerns relate to noise during dredging. See section 2.2 on aggregate extraction for studies on the impact of dredging on the marine environment. The assessment of the likelihood of committing a disturbance offence should be made and mitigation put in place if appropriate. There are no specific good practice guidelines on how to mitigate disturbance of marine EPS during this activity since the potential for impacts and its significance are considered to be low. Mitigation measures associated with this activity are mostly aimed at reducing the impacts on the seabed and associated benthos and the effects of suspended sediment concentrations.

3.2.10. Military sonar

The low- and mid- frequency military sonar operate at below 1000 Hz and between 1000 and 10000 Hz respectively [15], which fall inside many cetacean species’ hearing range. Sounds at these frequencies, coupled with high source levels, can give rise to potential impacts over large areas, since low frequency sounds travel farther.

It is generally agreed that some mid-frequency (3 – 10 kHz) sonar may impact on the survival of individuals of some beaked whale species[16; 17], following cases of mass-strandings and mortality which coincided with military sonar trials. Even though the mechanisms leading to the beaked whale mortality are unclear, the consistent pattern in the species affected and implicated sounds leave little doubt as to the cause and effect. Recent observations suggest that animals may develop decompression sickness[17; 18] due to an alteration of diving behaviour in response to sonar signals (e.g. surface too quickly and/or remain too long at the surface).

In order to reduce the potential disturbance to cetaceans caused by military sonar, the UK Ministry of Defence (MoD) has undertaken a number of measures, these include: internal environmental impact 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 so as to minimise 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); sonar not used if marine mammals are within a predetermined safe range; and the use of Marine Mammals Observers to continuously monitor the operational area.

The UK MoD has also continued 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 to manage this impact by providing advice on mitigation measures.

3.2.11. 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, for example, in areas of high energy tidal streams or range or where there is extensive wave power. While, generally speaking, the operation of offshore wind energy is not considered as being likely to give rise to significant effects on EPS this may not be the case with emerging novel technologies such as wave and tidal generation devices. These are novel interventions in the marine environment and their environmental impacts are not well studied. Currently there are no environmental guidelines available for these "wet" renewables, however, these will develop as the industry matures and the understanding of potential impacts increases.

Potential impacts may arise from physical collision with moving structures or from the noise generated by the operation of devices. The potential impacts of tidal and wave energy developments on cetaceans were assessed as part of the Scottish Marine Renewables Strategic Environmental Assessment (SEA) programme. The risk of collision with moving parts (e.g. turbine blades) was preliminarily assessed for harbour porpoises on the west coast of Scotland[vi] and it was estimated that within one year a large number of animals could potentially encounter the devices. However, whether the animals would become attracted or avoid the moving parts of the device is not known. Avoidance rates will be instrumental in determining the assessment of collision risk and therefore further research is needed on the behaviour of cetaceans in response to these devices.

Noise will be generated when the marine renewable devices are in operation, although in many cases, and particularly with smaller toothed whales, the audibility of the operational noise of these relatively small turbines will be restricted to close-ranges. The effect of windfarm operational noise on cetaceans with lower frequency hearing (e.g. minke whales) is unknown[19]. 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. The potential impact of the scaling up of single devices to larger, commercial, arrays of turbines also requires further research. Noise generated by vessels servicing the installations will also add to the noise signature of the activity.

3.2.12. 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: sailing, motor boating,

[vi] 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.

water skiing and personal watercraft (e.g. jetskis). Main areas of concern relate to collisions with vessels and engine noise. There has been little research carried out into the impact of this type of disturbance, and while disturbance more akin to harassment can be fairly straightforward to detect, the longer-term impacts to cetaceans exposed to high and persistent levels of these types of activities remain unknown. In 1999, Defra issued a set of Guidelines for minimising disturbance to cetaceans from recreation at sea.

3.2.13. Research on cetaceans

Research at sea on cetaceans may have the potential to cause disturbance through repeated 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. 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. In cases where there is a high likelihood that animals could be significantly disturbed (see section 2), it may be possible to apply for a wildlife licence under the scientific and education purpose (regulation 44(2)(a) and 49(6)(f)) of the HR and OMR respectively), if there is no suitable alternative and there is no risk to the FCS status (for example, photo-identification work from land).

It may also be possible to apply for a wildlife licence (under the scientific and education purpose), for filming cetaceans. Even though filming is likely to occur over a short period of time, if this is carried out on a population already subjected to other close approach pressures (e.g. photo id, whale watching) then a licence would probably be needed and any existing good practice guidelines (e.g. as those for whale watching) followed. If sufficient film material already exists then this may be considered a satisfactory alternative and no licence may be issued.

In the UK, there are no formal guidelines to minimise disturbance to cetaceans when carrying out research in the field. Nevertheless, commonsense measures include attempts to limit close approach to the animals for as strictly short period as possible. The CCW has issued a protocol for minimising disturbance to cetaceans when carrying out photo-identification studies. It is compulsory, in Welsh waters, to follow this as a condition of the wildlife licence.

3.2.14. Seismic and other geophysical surveys

Geophysical exploration is typically carried out using seismic surveys. In addition, sub-bottom profilers such as sparkers or boomers might be used to provide high resolution geophysical profiles along existing seismic lines or other areas. In addition, sonar surveys (e.g. sidescan sonar) can be used.

Seismic surveys

Seismic surveys are carried out in the United Kingdom Continental Shelf (UKCS) 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, typically containing tens of such cylinders, is discharged simultaneously, 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 continually fired and recharged with compressed air at intervals of approximately ten seconds, the timing dependent on the objectives of the survey. Seismic surveys typically produce short duration broadband impulse sounds with high peak source levels (220-255 dB re 1µPa peak at 1m).

The main area of concern with regards to seismic activity relates to the high intensity sound produced, which, if no mitigation measures are used, has the potential to cause injury and disturbance. 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. These high intensity pulsed sounds generated during seismic surveys can be repeated continuously and last for many weeks in an area.

The extent to which seismic disturbance from airguns affects cetaceans is not well known for all species. Baleen whales may be more affected by seismic surveys since their vocalisations and hearing sensitivity fall within the frequency bands with the highest source levels of airgun sounds. However, the airguns may also emit higher frequency sounds[20] that overlap with those used by toothed whales and dolphins (odontocetes). Therefore, most species of cetacean may be exposed to sounds produced during seismic surveys. Still, evidence of avoidance or short-term behavioural responses is contradictory and might vary depending on the species[1;10;21]. Using appropriate mitigation measures the potential for injury and disturbance should be much reduced.

The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (and 2007 amendments) implement the EU Habitats Directive for all oil and gas activities within the UKCS. Under these Regulations any company wishing to carry out a seismic survey must apply for consent from the Department for Business, Enterprise and Regulatory Reform (BERR, formerly DTI). The JNCC are consulted on whether consent should be granted for each individual seismic survey and if consent is granted, a standard mandatory condition is that the "JNCC Guidelines for minimising acoustic disturbance to marine mammals from seismic surveys" (we welcome feedback on the latest version, see Annex C) are always followed.

Another condition of a consent being granted to carry out a seismic survey is that a report is submitted to the JNCC for each individual 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 this data have been developed. The data from these forms is analysed by the JNCC and a series of reports have been published entitled Marine Mammal Observations during seismic surveys for the years 1996 to 2000 with the publication of the 2001 and 2002 reports currently in progress. In addition, one report on the Effects of seismic activity on marine mammals in UK waters, 1998-2000, has been published and another is planned to analyse the data from 2003-2006.

Work continues with the Industry and BERR on the development of Passive Acoustic Monitoring. The International Association of Oil & Gas Producers together with scientists have a projects within a Joint Industry Programme (JIP), that aim to identify knowledge gaps, increase understanding and mitigate the effects of underwater sound on marine animals (see http://www.soundandmarinelife.org/Site/index.html).

Side scan sonar surveys
Side scan sonar systems record a 2D view of the seabed to study its morphology. The use of this survey technique is commonplace in UK coastal waters. Side scan sonar also operates at much higher frequencies (typically around 200-500 kHz). Although output levels are relatively high (around 200db re 1 µPa-m), because of these higher frequencies (which attenuate more quickly) received levels fall off rapidly away from the source.

The potential impacts of side scan sonar on marine mammals are not well understood. The high frequencies produced are outside of the key hearing thresholds of, for example, the harbour porpoise, namely 1.4 - 2.5 kHz for communication and sonar-clicks (echolocation) at 110 - 140 kHz, and above the hearing level of most marine mammals. Additionally, the intermittent nature of side scan sonar signals results in lower noise doses than would occur for continuous signals. Furthermore the relatively small area ensonified (the equipment points downwards) and the short-term nature of the surveys mean that the risk of any potential impact will be extremely localised [15;22].

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 information required will determine the system chosen. ‘Pingers’ named due to their acoustic ‘pings’ operate on a range of single frequencies between 3.5kHz and 7kHz. “Boomer” surveys have a broader band acoustic source ranging between 500Hz to 5kHz. Although less commonly used today, ‘Sparker’ systems 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 that is swept electronically across a range of frequencies (i.e. a ‘chirp’) between 3kHz to 40kHz. Examples of sound pressure levels (SPL) recorded from a boomer operating at 350 joules are 204 dB re 1_{μ}Pa rms at 1m, and from a mini-sparker operating at 1.5 kilojoules are 209dB re 1_{μ}Pa rms at 1m[vii]. The actual SPL generated will depend upon the type of equipment used and its operating specifications, which will vary on a case-by-case basis. There is very little published information on the sound pressure levels generated from sub-bottom profiling equipment, either collected from field experimentation or from manufactures specifications. 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, or temporary displacement of small proportion of population[22]. No guidelines exist for the use of sub-bottom profiling equipment in the UK, the need for these will be re-assessed if further evidence of the effects generated by sub-bottom profiling equipment comes to light.

3.2.15. 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), 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[23]. The number of ships of the world fleet has tripled in the last 50 years and shipping noise levels have increased at the rate of approximately 3 dB per decade[23]. Particular concerns relate to noise generated by propeller

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

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.

Little is known on the potential impact on cetaceans of this overall, general increase in ambient noise levels from the ever increasing density of shipping activity. There is potential for disturbance mainly through "masking" (obscuring of sounds of interest by interfering sounds) of cetacean vocalisations. The likelihood of disturbance will depend on the species of cetacean, their behaviour, habituation, their habitat and the boat type and behaviour[10]. Management of shipping noise includes the development of vessel quieting technologies such as improved blade design for propellers and the reduction of vessel speed in sensitive areas.

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

In the UK, there are currently no good practice guidelines for minimisation of disturbance by shipping.

3.2.16. Whale-watching (both commercial and recreational)

Whale and dolphin watching around the UK coast has increased in the past 10 years, as both commercial ventures are set up and the public takes an interest in watching the animals in their natural habitat. In some areas, large numbers of boats might operate, and the potential for chronic exposure of cetaceans to disturbance can be high.

Concerns regarding whale-watching impacts on cetaceans relate mainly to the noise generated by the vessels and to risks of collision which could lead to injury and even death[24]. Accounts of short-term behavioural responses by cetaceans to whale watching vessel traffic abound but only recently is research showing that the repeated exposure of individual animals to boat interactions may lead to habitat displacement (particularly of more sensitive animals), and potentially to the lowered viability of some coastal bottlenose dolphin populations[25; 26; 27; 25; 27]. In addition, whale-watching has been cited as a likely contributing factor in recent population declines of southern resident killer whales in Canada[28].

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. Defra published in 1999, general guidelines for minimising disturbance to cetaceans from whale watching (Minimising disturbance to Cetaceans from Whale watching operations).

As a result of the Nature Conservation (Scotland) Act 2004, Scottish Natural Heritage has launched the Marine Wildlife Watching Code in Nov 2006. The Scottish Marine Wildlife Watching Code was developed for those who watch marine wildlife in Scotland - whether from the shore or at sea. This is not a regulatory instrument, but comprises recommendations, advice and information.

The Scottish Code and its guidance have been incorporated into the WiSe (Wildlife Safe) courses. The WiSe is 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 nature conservation country agencies 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.

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