

# **Guidelines for minimising acoustic disturbance to marine mammals from seismic surveys**

## **April 1998 Version**

These guidelines are aimed at minimising acoustic disturbance to marine mammals from seismic surveys and other operations where acoustic energy is released. Application of the guidelines is required under licence conditions in blocks licensed under the 16th and 17th rounds of offshore licensing. However, member companies of the UK Offshore Operators Association (UKOOA) and the International Association of Geophysical Contractors (IAGC) have indicated that they will comply with these guidelines in all areas of the UK Continental Shelf (UKCS) and in some cases elsewhere. The guidelines apply to all marine mammals, including seals, whales, dolphins and porpoises. All surveys using higher energy seismic sources (including site surveys as well as large scale seismic surveys) should comply with these guidelines.

## **Precautions to reduce the disturbance caused by seismic surveys**

Seismic surveys at sea do not necessarily constitute a threat to marine mammals, if care is taken to avoid situations which could potentially harm the animals.

### **A. The Planning Stage**

When a seismic survey is being planned, operators should:

- Contact the Joint Nature Conservation Committee (JNCC - see Further Information for address) to determine the likelihood that marine mammals will be encountered. In sensitive areas, the JNCC may request precautions in addition to those outlined below (for example, the special conditions attached to some oil and gas licences).
- In areas which are important for marine mammals (as indicated in consultation with the JNCC) operators should seek to provide the most appropriately qualified and experienced personnel to act as marine mammal observers on board the seismic survey vessel. If possible, such observers should be experienced cetacean biologists. As a minimum, it is recommended that observers should have attended an appropriate training course.
- If advised to do so by the JNCC, discuss the precautions which can be taken to reduce disturbance, and the design of any scientific studies with the Sea Mammal Research Unit (see Annex for address). In areas where marine mammals are abundant, properly conducted observation and recordings using qualified observers (see above) carried out before, during and after the seismic survey, can provide valuable information on its effect.
- Operators should plan surveys so that their timing will reduce the likelihood of encounters with marine mammals, although at present there is limited information on their distribution in some areas.
- Operators should seek to reduce and/or baffle unnecessary high frequency noise produced by air-guns or other acoustic energy sources.

### **B. During the Seismic Survey**

When conducting a seismic survey, the following guidelines should be followed:

#### **LOOK AND LISTEN**

Beginning at least 30 minutes before commencement of any use of the seismic sources, the operator and observers should carefully make a visual check from a suitable high observation platform to see if there are any marine mammals within 500 metres, using the cues mentioned later in these guidelines to detect the presence of cetaceans. Hydrophones and other listening equipment may provide additional information on the presence of inconspicuous species, such as harbour porpoises, or submerged animals, and should be used whenever possible. This will be particularly appropriate in poor weather, when visual evidence of marine mammal presence cannot be obtained.

#### **DELAY**

If marine mammals are present, the start of the seismic sources should be delayed until they have moved away, allowing adequate time after the last sighting (at least 20 minutes) for the animals to move well out of range. Hydrophones may also be useful in determining when cetaceans have moved. In situations where seal(s) are

congregating immediately around a platform, it is recommended that commencement of the seismic sources begins at least 500 m from the platform.

#### THE SLOW BUILD UP

Where equipment allows, power should be built up slowly from a low energy start-up (e.g. starting with the smallest air-gun in the array and gradually adding in others) over at least 20 minutes to give adequate time for marine mammals to leave the vicinity. There should be a soft start every time the air-guns are used, even if no marine mammals have been seen. The soft start may only be waived for surveys where the seismic sources always remain at low power levels e.g. some site surveys.

#### KEEP IT LOW

Throughout the survey, the lowest practicable power levels should be used.

### **C. Report after the survey**

A report detailing marine mammals sighted (standard forms are available from JNCC), the methods used to detect them, problems encountered, and any other comments will help increase our knowledge and allow us to improve these guidelines. Reports should be sent to the JNCC (see Further Information for address). Reports should include the following information:

- Date and location of survey
- Number and volume of airguns used
- Nature of air-gun discharge frequency (in Hz), intensity (in dB re. 1 $\mu$ Pa or bar metres) and firing interval (seconds), or details of other acoustic energy used
- Number and types of vessels involved in the survey
- A record of all occasions when the air-guns were used, including the watch beforehand and the duration of the soft-start (using standard forms)
- Details of any problems encountered during marine mammal detection procedures, or during the survey
- Marine mammal sightings (using standard forms)
- Details of watches made for marine mammals and the seismic activity during watches (using standard forms)
- Reports from any observers on board

#### Background to the guidelines

These guidelines reflect principles which could be used by anyone planning marine operations that could cause acoustic or physical disturbance to marine mammals. The recommendations contained in the guidelines should assist in ensuring that all marine mammals in areas of proposed seismic survey activity are protected against possible injury, and disturbance is minimised.

The guidelines were originally prepared by a Working Group convened at the request of the Department of the Environment, developed from a draft prepared by the Sea Mammal Research Unit. The guidelines have been reviewed twice by the Joint Nature Conservation Committee following consultation with interested parties and in the light of experience after their use since 1995.

Please note: As these guidelines are concerned with reducing risks to marine mammals, all other notifications should be given as normal.

### **Existing protection**

Section 9 of the Wildlife and Countryside Act 1981 prohibits deliberate killing, injuring or disturbance of any cetacean (equivalent in Northern Ireland is Article 10 of the Wildlife (Northern Ireland) Order 1985). This reflects 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), implemented by The Conservation (Natural Habitats, etc.) Regulations 1994 and The Conservation (Natural Habitats, etc.) Regulations Northern Ireland 1995.

In addition, the UK is a signatory to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas and has applied its provisions in all UK waters. Amongst other actions required to conserve and manage populations of small cetaceans, the Agreement requires range states to "work towards....the prevention of ...disturbance, especially of an acoustic nature".

### **Marine mammal presence in UK waters**

Records indicate there may be 22 species of cetacean either resident in, or passing through, UK waters. There are 9 regular visitors seen in coastal waters, the most common species of which are harbour porpoise, white-beaked dolphin, bottlenose dolphin and common dolphin; the most common seen in deeper offshore seas are the long-finned pilot whale, common dolphin, harbour porpoise and killer whale. Northern right whales are very rare - they are an endangered species, having been hunted very close to extinction.

There are two species of seal which are resident in UK waters, the common or harbour seal and the grey seal. Both species breed in the UK, with common seals pupping in June/ July, and grey seals pupping from September to December, the exact timing depending on their location. Seals may be particularly vulnerable to disturbance during the pupping season. Other species, such as the hooded seal, may occasionally be seen in waters to the north of the UK.

### **Cues for detecting the presence of cetaceans**

Even when quite close to vessels, cetaceans are often difficult to detect. The following points should help in ensuring that an adequate search has been made.

- Seismic operators should allow adequate time (at least 30 minutes) for sightings to be made prior to commencement of any use of the seismic sources
- The ease of detecting cetaceans declines with increasing sea state, so care should be taken to ensure an adequate search has been made in the prevailing conditions.
- Searches should be made from a high vantage point with a clear all-round view, e.g. the bridge roof or crow's nest. If necessary use two or more vantage points to give an all-round view.
- The sea should first be scanned slowly with the naked eye and then scanned slowly with binoculars.
- Hydrophones are a useful aid to detecting cetaceans. Cetaceans communicate with each other using whistles, creaks, chirps and moans which may be heard over considerable distances. Trains of clicks are used for echolocation and while foraging. They may be heard with a hydrophone at distances of several kilometres. In areas which are known to be frequented by small cetaceans, any hydrophones used should be capable of receiving the high frequency sounds used by these animals.
- Submerged cetaceans are much more at risk than those on the surface. This makes it particularly important to use a hydrophone whenever possible to detect vocally active animals that may be invisible from the surface.
- Dolphins and porpoises generally surface 2-3 times per minute in order to breathe. Dive times and surfacing behaviour are more erratic when they are feeding, but most dives are unlikely to exceed 5 minutes. Large whales surface less often and may remain submerged for some time.
- Splashes may be a cue to the presence of cetaceans, although in seas rougher than sea state 2 cetacean splashes may be difficult to detect and distinguish from wave splashes.
- Blows of large whales may be more obvious, but still may be difficult to detect in strong winds.
- Some species may be attracted to boats from some distance away, probably by engine noise. They may accompany a vessel for a considerable period and even bowride if it is fast-moving. If possible, look over the bow of the ship to check for cetaceans close in to the ship which may be hidden from view from the normal vantage points. The arrays of hydrophones which are towed by survey vessels may also be attractive to dolphins.
- Feeding seabirds can sometimes be evidence of the presence of cetaceans. Species which are likely to associate with cetaceans include gannets, kittiwakes and Manx shearwaters, although any flock of birds should be checked for the possible presence of cetaceans.
- An oily slick at the sea surface may signify the presence of cetaceans. These slicks may also be attractive to birds such as fulmars and storm petrels.
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Cetaceans are capable of brief swimming speeds of 30 knots (34 mph), and sustained movement at 8 knots (10 mph), although some may swim at much slower speeds. If disturbed, they may alter their heading rapidly.

## Seismic surveys

Modern large-scale surveys are conducted using towed arrays of "air-guns" - cylinders of compressed air. Each cylinder contains a small volume (typically between 10 and 100 cubic inches) at a pressure of about 2000 psi. The array, typically containing some tens of such cylinders, is discharged simultaneously, to generate a pressure pulse which travels downwards into the sea bed. Some of this acoustic energy is emitted into the wider marine environment; however, the designers of air-gun arrays seek to maximise the transmission of energy into the sea bed, with the result that the energy dissipated into the wider environment is reduced. As a survey proceeds, the air-gun array is recharged with air from a compressor on board the towing vessel. The process is repeated at intervals of approximately ten seconds - the timing dependent on the objectives of the survey.

Potential effects of acoustic disturbance on cetaceans

The most prevalent form of acoustic disturbance in UK waters is probably the noise generated by boats; however, the noise caused by boat traffic is so widespread that many cetacean populations may have become used to it, although this does not necessarily mean that the animals are unaffected. The limited research on the effects of disturbance due to the passage of vessels shows there is some evidence that cetaceans will avoid approaching ships and may alter migration routes in response to marine traffic.

## Effects of seismic surveys

The extent to which seismic disturbance from airguns affects cetaceans is not well known for all species, since only a limited amount of research has been done (see Annex for further details). Most published research relates to the effect on large whales (particularly bowhead whales) of older air-gun arrays, which were different from those currently in use.

Seismic air-guns are designed to produce low frequency noise, generally below 200 Hz, used to build up a picture of the seabed and the underlying strata. However, recent research has shown that high frequency noise is also produced (Goold 1996a). Low frequency noise is more likely to disturb baleen whales than toothed dolphins; baleen whales communicate at frequencies mostly below 3 kHz, which are likely to overlap with the dominant frequencies used by seismic air-guns. The sensitivity of toothed dolphins to sound falls sharply below 1 kHz, and sounds below 0.2 kHz are probably inaudible to them. The sounds used by dolphins for communication are often above 4.8 kHz, and echolocation sounds can occur up to 200 kHz. Goold (1996a) found significant levels of energy across the recorded bandwidth up to 22 kHz. This high frequency noise, incidental to seismic operations, will overlap with the frequencies used by toothed dolphins, and could potentially cause disturbance. There is some evidence of disturbance of dolphins by seismic activity (Goold 1996b, Stone 1997, 1998).

Seismic activity could have a number of different effects on small cetaceans: it may interfere with communication or alter behaviour. In the worst case, there is some risk of physical damage in the immediate vicinity of air-guns. There is no evidence to suggest that injury has occurred to any cetacean in UK waters as a result of seismic activity, although such injuries may be difficult to detect. Seismic surveys may have indirect effects on local cetacean populations because of changes they may cause in the distribution of prey species.

The risk to cetaceans is increased by their natural inquisitiveness, and the fact that they may be attracted to areas of human activity where seismic surveying is about to take place.

Further information and comments on these guidelines

Standard forms (electronic and hard copy) are available for observers on seismic surveys. Please contact Mark Tasker at the address shown below.

If you have any comments or questions on these guidelines, or suggestions on how they may be improved, please contact:

Zoe Crutchfield, (zoe.crutchfield@jncc.gov.uk)

Joint Nature Conservation Committee, Dunnet House, 7, Thistle Place, ABERDEEN, AB10 1UZ

Telephone 01224 655716

Fax 01224 621488

## **ANNEX**

### **CONTACT NAMES AND ADDRESSES**

Trevor Salmon, Department of the Environment, European Wildlife Division (TG 9/02), Tollgate House, Houlton Street, BRISTOL, BS2 9DJ  
Telephone 0117 987 8854  
Fax 0117 987 8642

(And, if requested to contact the Sea Mammal Research Unit)

Prof. John Harwood, Sea Mammal Research Unit, Gatty Marine Laboratory, University of St Andrews, St. Andrews, FIFE, KY16 8LB  
Telephone 01334 462630  
Fax 01334 462632

### **FURTHER INFORMATION**

Davis et al. 1990. State of the Arctic Environment, Report on Underwater Noise. Prepared by LGL Ltd, PO Box 280, King City, Ontario, Canada L0G 1K0. Prepared for the Finnish Initiative on Underwater Noise. Provides a useful summary of the available scientific information of the possible effects of acoustic disturbance on cetaceans.

Environmental Guidelines for Exploration Operations in Nearshore and Sensitive Areas, published by the UK Offshore Operators Association, 3 Hans Crescent, London SW1X 0LN.

Evans, P.G.H. & Nice, H. 1996. Review of the effects of underwater sound generated by seismic surveys on cetaceans. Report to UKOOA, Sea Watch Foundation, Oxford.

Goold, J.C. 1996a. Broadband characteristics and propagation of air gun acoustic emissions in the southern Irish Sea. (in press).

Goold, J.C. 1996b. Acoustic assessment of populations of common dolphin *Delphinus delphis* in conjunction with seismic surveying *Journal of the Marine Biological Association* 76: 811-820.

Moscrop, A. & Simmonds, M. 1994. The threats posed by noise pollution and other disturbances to the health and integrity of cetacean populations around the UK. A report for the Whale and Dolphin Conservation Society, pp. 1-8. (Includes a review of work on acoustic disturbance of cetaceans). Available from the Whale and Dolphin Conservation Society, Alexander House, James Street West, Bath, Avon, BA1 2BT.

Richardson, W.J., Fraker, M.A., Würsig, B. & Wells, R. 1985. Behaviour of bowhead whales *Balaena mysticetus* summering in the Beaufort Sea: reactions to industrial activities. *Biological Conservation* 32: 195-230.

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

Stone, C.J. 1997. Cetacean observations during seismic surveys in 1996. JNCC Reports, No. 228.

Stone, C.J. 1998. Cetacean observations during seismic surveys in 1997. JNCC Reports, No. 278.

Turnpenny, A.W.H. & Nedwell, J.R. 1994. *The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sound Generated by Seismic Surveys*. Fawley Aquatic Research Laboratories Ltd, Fawley, Southampton SO45 1TW. (This includes an extensive further bibliography). Available from United Kingdom Offshore Operators Association, 3 Hans Crescent, London, SW1X 0LN.

### **USEFUL CETACEAN IDENTIFICATION GUIDES:**

Cawardine, M. 1995. *Eyewitness handbooks - Whales, dolphins and porpoises*. Dorling Kindersley. ISBN 0-7513-1030-1. Price £14.99. Available from bookshops.

Evans, P.G.H. 1995. Guide to the identification of whales, dolphins and porpoises in European seas. Sea Watch Foundation Publication, Oxford. Available from Sea Watch Foundation, Unit 29, Southwater Industrial Estate, Station Road, Southwater, West Sussex RH13 7UD. Price £5.00 + 50p p&p.

Leatherwood, S. & Reeves, R.R. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco. ISBN 0-87156-341-X (hardback) ISBN 0-87156-340-1 (paperback). Available from some bookshops.

Sea Watch Foundation / BBC Wildlife 1994. Identification guide to whales and dolphins of the British Isles. Laminated wall chart available from Sea Watch Foundation Publication, Oxford. Available from Sea Watch Foundation, Unit 29, Southwater Industrial Estate, Station Road, Southwater, West Sussex RH13 7UD. Price £2.95 + £1.00 p&p.