

GUIDE TO USING MARINE MAMMAL RECORDING FORMS

The Marine Mammal Recording Forms were designed under a project funded by the International Association of Oil and Gas Producers (OGP) Joint Industry Programme (JIP) on Sound and Marine Life. The forms are aimed primarily at seismic surveys, but could also be used for other operations. They are intended for use globally wherever regulators accept them (those who have indicated their acceptance of these forms are listed at the end of this document), therefore contain information relevant to several jurisdictions – not all fields are required for all jurisdictions (e.g. *Length of power-down and/ or shut-down* is not required for UK waters).

The forms are in Excel, in a workbook containing four spreadsheets:

- 1). Cover page - contains general information about the survey
- 2). Operations - contains details of the use of the source
- 3). Effort - contains details of your watches/ acoustic monitoring for marine mammals
- 4). Sightings - contains details of sightings/ acoustic detections

Many of the fields (columns) within each spreadsheet have input messages that appear when you click on a cell in that field, giving guidance regarding the information required. All fields have data validation that will only allow entries in an appropriate format. In some cases the validation is simply a restriction on the maximum number of characters allowed, while in others there are stricter limitations, e.g. numbers within a certain range, or a valid date or time. In some cases entries are restricted to a list of options, with drop-down boxes for selecting one of the correct options. If an invalid entry is made an error alert will give guidance regarding the restrictions for that field.

Each spreadsheet has the fields *Comments* and *Flag record*. Comments should be used only where important information cannot be conveyed within the other fields on the forms. A record should be flagged if an MMO wishes to draw attention to a particular event, for example for the relevant regulator to determine whether there has been compliance with guidelines or regulations.

Printer-friendly versions of the forms are available as Word documents known as Deckforms. These are for use when recording hand-written observations whilst on deck, and act as an aide memoire to ensure that MMOs collect all the necessary information for completing the Excel spreadsheets. Records made on the Deckforms must be transcribed to the Excel spreadsheets prior to submission of the forms. The Deckforms are not intended for submission to regulators.

In order to facilitate importation of data into a database, please observe the following:

- Do not leave blank lines between records
- Do not add additional columns (if you feel that something else is important this should be put in the *Comments* - in exceptional cases if there is a genuine need for additional columns, these should be placed at the end of, not between, the existing columns)
- Do not delete columns
- Do not change columns
- Do not change the order of columns
- Do not change the validation settings
- Do not use formulae
- Do not use N/A where data are not available, just leave the cell blank
- Do not submit as a pdf, the original Excel file should be submitted with the MMO report.

General hints on completion of the spreadsheets

Don't use all upper case characters on the forms. In many cases (particularly fields with drop-down options) entries should be in lower case, although where you write some text (e.g. *Description* on the Sighting form) it is acceptable to use an upper case character at the beginning of any sentence. Upper case characters at the beginning of names (people, companies or ship) should also be used.

Data should be recorded for miniguns in the same way as for larger airguns. Operations data must be included for miniguns, and fields relating to the source on the other forms should be completed according to whether the minigun is firing or not.

The ship's name (on all forms) should not have MV (or similar) in front of it.

Times should use the 24 hour clock, and should be in UTC. Times should be entered with a colon between the hours and minutes, i.e. hh:mm. Failure to use the separator will result in the entry not being recognised as a time and therefore being invalid. Start a new line at midnight UTC on the Effort form, but not on the Operations form.

Dates should be entered with slashes between day, month and year, i.e. dd/mm/yyyy (a two digit entry for year will automatically be changed to a four digit entry, e.g. 08 becomes 2008). Failure to use the separator when entering the date will result in the entry changing to an incorrect date.

Where there are both MMOs and PAM operators on a vessel, they should take care not to duplicate data. For example, there should be only one Cover Page and one set of Operations data. MMOs and PAM operators should each record their own Effort data and Sightings/ acoustic detections, although these can be included in the same Excel workbook, or separate workbooks if this is easier (although both should ideally be submitted within one report for the survey). Records of animals detected both visually and acoustically should not be duplicated on the Sighting form.

Regulatory reference number and *Ship/ platform name* are included on all four forms. In the majority of cases these will stay the same throughout a job, but there are occasions when the ship may change or more than one survey may be run concurrently so the regulatory reference number will change back and forth, even sometimes within one day. Therefore it is necessary to include these fields on all four forms. Where these entries do not change during a job (as in the majority of cases) it is easy to copy records between rows by using Ctrl + D or clicking on the lower right corner of the cell and dragging down (if this results in a sequential increase in the regulatory reference number go to the Auto Fill Options to the right of the dragged selection, click on the down arrow and check Copy Cells).

If a field is not applicable or data is not available, please leave it blank. Do not put N/A or any equivalent entry. During analysis there is a need to be able to exclude or include records with no data (regardless of the reason why there is no data) and this is most easily done by selecting records that are not/ are null. The use of N/A or equivalent entries therefore interferes with this aspect of analysis and should be avoided.

During analysis, weather conditions at the time of a sighting or during a pre-shooting search are taken from the weather recorded at that time on the Effort form. It is therefore important that weather is recorded accurately on the Effort form and new entries are made on the Effort form if the weather conditions change (more information on this is provided under the section below on the Effort form). Weather is not recorded separately on the Sighting form as it needs to match that recorded on the Effort form, otherwise it causes errors in analysis, and this matching is best done by linking with the weather recorded on the Effort form at the time of analysis. For the few occasions

when animals are spotted while you are not on watch (and therefore not completing the Effort form), weather information can be added in the *Comments* field of the Sighting form.

Some fields where you will enter some text have a limit on the number of characters. Please do not change this limit otherwise data will be lost on importation to any database modelled on the forms. For example, 255 characters (the limit on the *Comments*, *Description* and *Behaviour* fields) is the maximum allowable in a text field in an Access database.

If there are any instances of non-compliance, you are encouraged to provide additional information relating to those instances (including reasons) in the *Comments* fields.

The following sections provide specific guidance on some (but not all) fields on each spreadsheet. Those fields not covered in the following sections are assumed to be relatively straightforward and self-explanatory.

Cover Page

Regulatory reference number - This should be the unique reference given to each survey/ operation by the regulating authority. For seismic surveys in UK waters it would be the DECC reference number, for seismic surveys in the US Gulf of Mexico it would be the BOEM permit number or OCS lease number etc. This reference number will normally be the same on all four spreadsheets (Cover Page, Operations, Effort and Sightings). For the rare occasions when more than one survey (with different regulatory reference numbers) is run concurrently, please take care to ensure that each record on each spreadsheet has the correct regulatory reference number.

Location - this is the general location of the survey, e.g. quadrant and block.

Survey type - 2D site surveys should be recorded as “site” not “2d”. The category “obc” includes similar surveys such as OBN or OBS surveys.

Start date and End date - If the parameters recorded on the Cover Page do not change during the survey, these would be the start and end date of the survey, and there would be just one line of data on the Cover Page. If the details recorded do change and there is more than one line of data on the Cover Page, then the dates should be the start and end dates of the period when those details applied. See the example in Figure 1 below. For most surveys there will be just one record on this form.

G	H	I	J		Z	W	X	Y
Survey type (site, 2D, 3D, 4D, OBC, VSP, etc.)	Start date	End date	Number of source vessels	Type of source (e.g. airgun)	Was source activated?	Number of dedicated MMOs	Training of MMOs	Was PAM used
3d	01/03/2011	31/03/2011	1	Airgun		1	u	n
3d	01/04/2011	28/04/2011	1	Airgun		2	u	n

Figure 1. Example showing more than one line on the Cover Page where parameters change (highlighted) during the course of a survey. Start and end dates should be those of the period when the data on that line of the form apply (e.g. 1 MMO from 1st-31st March, 2 MMOs from 1st-28th April). Intervening columns are omitted from the illustration.

Frequency - This can be obtained from the crew and should be the range of frequencies over which peak energy is emitted. The crew may have a graph from which this can be read, as in Figure 2.

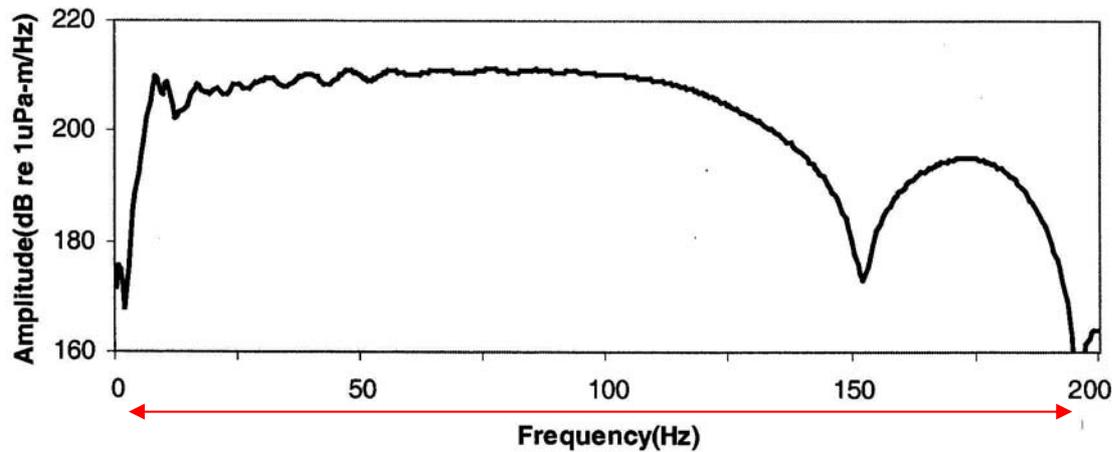


Figure 2. Amplitude spectrum, with range of frequencies over which peak energy is emitted highlighted.

Intensity - This is the primary peak-to-peak amplitude (may be called peak-to-trough). Units should be included, either dB or bar metres. The crew may have a graph from which this can be read, as in Figure 3. For piling operations this field can be used to record the pile energy in kilojoules.

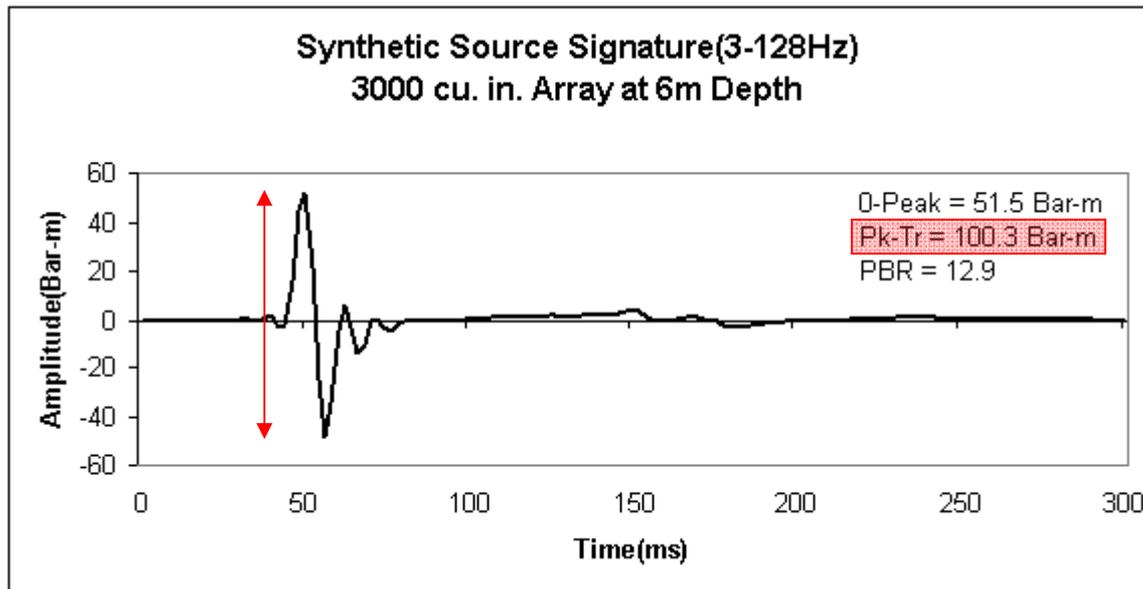


Figure 3. Example of graph from which intensity can be taken (peak-to peak, here called peak-to-trough, value highlighted).

Shot point interval - This is normally measured in metres along the ground, and can be obtained from the crew. For piling operations this field can be used to record the piling interval in seconds.

Method of soft start – In some jurisdictions, such as the UK, there are alternative options (increasing the pressure or increasing the frequency) for performing a soft start for some types of survey. These options are reflected in the drop-down list, as are combinations of these methods that may occasionally be used.

Magnification of optical equipment - If using binoculars it is just the first number that refers to the magnification, e.g. for 8 x 30 binoculars the magnification is 8. (The second figure is the diameter of the objective lens). If more than one pair of binoculars (with different magnifications) is used, record all magnifications, separating them by commas.

Height of eye - Enter the height of eye above the water of your usual observation position. If you use more than one observation position enter the height of the one you use most (you may note the height of an alternative position in the *Comments* field if you wish).

How was distance of animals estimated - Enter the most usual method you were using to judge accurately the distance to animals.

Number of dedicated MMOs - This refers only to those MMOs who have no other duties on board during any periods of seismic activity.

Training of MMOs - This applies to both dedicated and non-dedicated MMOs. If there is more than one MMO and training differs between them, enter the training of the lead MMO here and in the *Comments* field note the training of the other MMO(s). If MMOs have done more than one training course, choose the one most relevant to the jurisdiction of operation. The options reflect courses that are currently available or are due to become available in the foreseeable future.

Description of PAM equipment - This should be a brief description - a more detailed description can be given in the text of the report.

Bearing of hydrophones from airguns - This is relative to the direction of travel. See the examples in Figure 4 for an explanation.

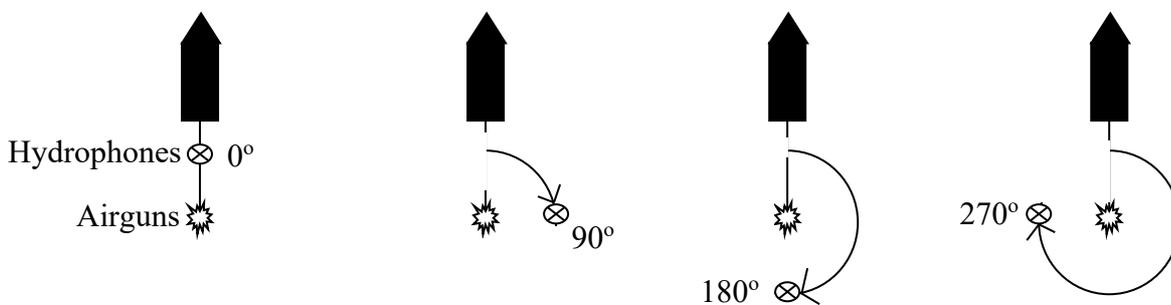


Figure 4. Examples showing the bearing of PAM hydrophones from airguns.

Operations

The purpose of the Operations form is to assess compliance with the guidelines/ regulations. As they will be used to assess compliance, the times of airgun activity on this form should be accurately recorded - you will probably need to obtain these times from the crew. Formulae must not be used for completing the Operations form, all times should be entered manually and be an accurate record of actual events. All items required on the Operations form relate to the use of the source, therefore the times when the source was active are entered first, and the times of your watches/ PAM relate to this.

On the Operations form, some fields may need to be left blank on some occasions, e.g. if a soft start began but was aborted before full power was reached, the time the soft start began and the time the

airguns stopped would be entered, but the times of full power, start of line, end of line and reduced output would be left blank.

If the source continues to be active over midnight, please continue on the same line of the Operations form - do not start a new line just because midnight has been reached.

If different size arrays are used during a survey (e.g. a site survey that uses a minigun for some of the time) the size of array in use for any given line should be indicated in the *Comments* field. There is no need to record the line number in the *Comments* field.

For lines that span the waters of different countries Operations data for the whole line should be included; the *Comments* field can be used to record which country's waters the line started or ended in.

Date - This is the date of the first time of source activity that is entered on this line of the form. For example, if the soft start begins before midnight but full power or the start of line is after midnight, it is the date the soft start began that should be entered in this field.

Time of full power - If full power is not reached (maybe because shooting was aborted during the soft start) then this should be left blank but the time when shooting ended should be recorded in the field *Time airguns/ source stopped*.

Time of start of line and *Time of end of line* - Times for each survey line should be entered on separate lines on the Operations form, even if shooting is continuous between lines (in circumstances where this is permitted under the guidelines/ regulations). This enables the duration of turns to be calculated during analysis. See the example in Figure 5. (See also comment below under *Time airguns/ source stopped*).

	E	F	G	H	I	J	
	Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time shooting started (UTC)
	7:15	7:35	7:36	8:01			
			8:35	9:01			
			9:26	9:53			
			10:26	10:57		10:57	

Figure 5. Example showing how separate survey lines should be shown on separate lines on the Operations form, even if shooting is continuous between lines (where this is permitted under the guidelines/ regulations).

Time of reduced output - This is only relevant if the volume of airguns firing is reduced.

Time airguns/ source stopped - If shooting stops on a different date from that entered in the *Date* field, put the date when shooting stopped in the *Comments* field. If shooting continues between survey lines (in circumstances where this is permitted under the guidelines/ regulations) then clearly there will be no entry in this field for many lines on this form. However, where shooting is permitted to be continuous between survey lines the times for each survey line should be recorded on separate lines of the Operations form - see the example in Figure 5 above.

Time pre-shooting search began, Time search ended, Time PAM began and Time PAM ended - These times should be filled in every time a visual watch or PAM is used prior to or during use of the airguns. If a visual watch or PAM is continuous over several survey lines (e.g. if two MMOs are working shifts), these times should be entered even if this means copying times from the record above/ below - this method of recording is shown in Figure 6 (a). Alternatively, from your watch/ PAM select the period that you were required to watch/ monitor relating to this period of shooting, even though you may have been watching/ monitoring prior to or after this. Figure 6(b) shows this method of recording for an example where a 30 minute pre-shooting search was required. However you choose to record it, you should be able to demonstrate on this form that you adequately covered the periods you were required to watch/ monitor - either method shown in Figures 6 (a) and (b) will demonstrate this when the data is analysed, so either method is acceptable. However, the example shown in Figure 6 (c), where gaps are left in some columns where start or end times of watches/ PAM “carry over” from the previous line or into the next line, will hinder analysis of the data as there is missing information on each line of the form. When dealing with large volumes of data compliance will be assessed using data analysis, rather than visually examining all records. In the example in Figure 6 (c), although to the human eye it is apparent that the pre-shooting search period was adequately covered, when these data are analysed each line will be examined on its own, therefore it will not be possible to demonstrate that watches/ PAM adequately covered the required pre-shooting search period because of the missing information on each line. Therefore the method of recording visual watch/ PAM times shown in Figure 6 (c) should not be used.

E	F	G	H	I	J	K	L	M	N	O	P
Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?
2:23	2:43	2:44	4:35		4:35			1:30	7:00	s	n
6:21	6:41	6:42	8:37		8:37			1:30	7:00	s	n
10:25	10:45	10:46	12:35		12:35	7:00	19:00			s	d
14:28	14:48	14:49	16:41		16:41	7:00	19:00			s	d
18:36	18:56	18:57	20:43		20:43	7:00	19:00			s	d

Figure 6 (a). Correct version of how to record watches/ PAM that continue over several survey lines - method where start and end times of searches/ PAM are copied between lines, with no gaps in data. It can be seen that watches/ PAM covered the required search period (this example assumes a 30 minute pre-shooting search was required).

E	F	G	H	I	J	K	L	M	N	O	P
Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?
2:23	2:43	2:44	4:35		4:35			1:53	2:23	s	n
6:21	6:41	6:42	8:37		8:37			5:51	6:21	s	n
10:25	10:45	10:46	12:35		12:35	9:55	10:25			s	d
14:28	14:48	14:49	16:41		16:41	13:58	14:28			s	d
18:36	18:56	18:57	20:43		20:43	18:06	18:36			s	d

Figure 6 (b). Correct version of how to record watches/ PAM that continue over several survey lines - method where only periods relating to required searches are entered, even though the watch/ PAM may have started earlier and carried on later (in this example PAM was continuous from 1:30 to 7:00 and the visual watch was continuous from 7:00 to 19:00, i.e. the same as in Figure 6 (a), but periods where the watch/ PAM was required have been extracted from these times). It can be seen that watches/ PAM covered the required search period (again assumes a 30 minute pre-shooting search was required).

E	F	G	H	I	J	K	L	M	N	O	P
Time soft start/ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?
2:23	2:43	2:44	4:35		4:35			1:30		s	n
6:21	6:41	6:42	8:37		8:37				7:00	s	n
10:25	10:45	10:46	12:35		12:35	7:00				s	d
14:28	14:48	14:49	16:41		16:41					s	d
18:36	18:56	18:57	20:43		20:43		19:00			s	d

Figure 6 (c). Incorrect version of how to record watches/ PAM that continue over several survey lines - gaps (highlighted) in data. When this data is analysed it will not be possible to show that watches/ PAM covered the whole required search period (again assumes a 30 minute pre-shooting search was required), due to the gaps in data. For example, for the soft start beginning at 14:28 it will appear that there was no-pre-shooting search.

Depth range - This is the depth range during the pre-shooting search period. If the pre-shooting search is entirely in waters less than 200 m depth, use “s”. If the pre-shooting search is entirely in waters deeper than 200 m use “d”. If the water depth during the pre-shooting search includes both waters shallower and deeper than 200 m use “b” (for jurisdictions where the duration of the pre-shooting search varies depending on depth you would be expected to conduct the longer search).

Effort

Only fill in the Effort form for periods actually spent observing (i.e. concentrating on continually watching the sea surface searching for marine mammals). Being awake and available does not count as being on watch, nor does taking casual glances at the sea now and again. If you cannot watch properly, do not fill in this form (casual sightings may still be recorded on the Sightings form). Each observer is expected to have sufficient rest breaks to enable them to maintain concentration while they are watching.

The Effort form can be used for periods of acoustic monitoring as well as visual monitoring. This form is used when calculating sighting/ detection rates of animals, as the number of sightings/ detections needs to be put into context of the length of time spent watching/ monitoring. When comparisons in sighting/ detection rates are made, variables such as location, observer, weather conditions and source activity that may influence the number of sightings/ detections need to be taken into account, so these variables are recorded on the Effort form also.

Take care entering positions on the Effort form – check that the position makes sense relative to the last position that was recorded.

It is important that a new line on the Effort form is entered whenever source activity or weather conditions (particularly sea state, swell, visibility, sun glare or precipitation) change. This requires that you remain aware of the source activity at all times - this awareness is also required to ensure compliance with the guidelines/ regulations. A new line should also be entered on the Effort form at least once an hour as a minimum, even if source activity and weather conditions remain the same – a record is needed at least once an hour to give a reasonably frequent record of position and speed (which may be used to calculate km travelled), and it also serves to remind the MMO to check whether weather conditions have changed. For a demonstration of how to complete the Effort form starting new lines when appropriate see the example in Figure 7 (see also the explanations under the paragraphs below on various individual fields in this form).

F	G	H		X	Y	Z	AA	AB	AC	AD
WEATHER CONDITIONS CHANGING				REPORTING ON CONTINUALLY SCANNING THE SEA SURFACE SEARCHING						
Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity		Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation
5:40	6:15	n		nw	3 s	s	o	g	n	n
6:15	6:39	s	→	nw	3 s	s	o	g	n	n
6:39	7:35	f		nw	3 s	s	o	g	n	n
8:00	8:30	f		nw	3 s	s	o	g	n	n
8:30	9:30	f		nw	4 c	s	o	g	n	n
9:30	10:30	f	→	nw	4 c	s	o	g	n	n
10:30	10:44	f		nw	4 c	s	o	g	n	n
10:44	11:40	n		nw	4 c	s	o	g	n	n
11:40	12:00	n		nw	4 c	s	o	g	n	n

Figure 7. Example showing how new entries are made on the Effort form each time source activity changes (highlighted in red) or weather conditions change (highlighted in blue), and at least every hour (highlighted in orange) and after any break in observations (highlighted in green). Intervening columns on the form are omitted from the illustration.

Observer - please put the observer's/ PAM operator's name, and not just MMO or PAM operator. Put the full name (first name and surname) not initials, as many observers share the same initials.

Time of start of section of watch and *Time of end of section of watch* - You should enter a new line on the Effort form each time source activity or weather conditions change, and at least every hour as a minimum. You will find that most watches you do are broken down into several lines on this form, each line containing one section of that watch. The start and end times refer to that section of the watch, i.e. relating to the information on that line of the form. Often the end time of the watch on one line of the form will be the same as the start time of the watch on the next line. See example below under *Start position*, *End position*, *Depth of water at start position* and *Depth of water at end position*. If your watch/ PAM extends over midnight, start a new line at midnight UTC (i.e. 00:00).

Source activity - This should be the source activity that applied throughout the whole period of the record. If source activity changes you should start a new line on the Effort form. There are a number of categories of source activity to choose from. Category “n” is used when the airguns are not firing. The category “s” is used for the soft start (during the pre-shooting search the source activity will be “n”, not “s”, as the soft start has not yet begun). You should change source activity to “s” and start a new line on the Effort form as soon as you become aware that the soft start has commenced - although you may not be aware of the exact instant when the soft start commences whilst observing, you should become aware that it has commenced within a couple of minutes and therefore would take a position and start a new line on the Effort form (you will need to record the exact time of the commencement of the soft start on the Operations form, but this can be obtained from the crew and done retrospectively). Category “f” is used for shooting at full power, therefore once full power is reached you should change source activity to “f” and start a new line on the Effort form (you may need to ask the crew to inform you when full power is reached – again it is acceptable on this form to record the time and position etc. of full power within a few minutes, although the exact time should be entered on the Operations form, which can be done retrospectively). Once shooting stops, source activity should change to “n” again and a new line should be entered on the Effort form. The category “r” should be used if power is reduced for some reason (reduced volume of airguns – if the full array continues at an increased shot point interval category “f” still applies) and “v” if the power level is varying, as it may do during some gun tests. The example in Figure 7 above shows how a new line should be entered on the Effort form each time source activity changes (highlighted in red).

Start position, End position, Depth of water at start position and Depth of water at end position - A new entry needs to be recorded on this form each time source activity or weather conditions change, and at least every hour as a minimum. Therefore you will find that, just as the start time of the watch on one line of the form is often (but not always) the same as the end time of the watch on the previous line, so also the start position and depth on one line will often (but not always) be the same as the end position and depth on the previous line of the form. See the example in Figure 8.

WEATHER CONDITIONS CHANGE, AND AT LEAST ONCE AN HOUR. START A NEW LINE AT MIDNIGHT UTC. ONLY FILL IN THIS FORM WHEN YOU ARE COM																
Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/south	End position - degrees longitude	End position - minutes longitude	End position - east/west	Depth of water at end position (metres)
5:40	6:15		57	15.31	n	0	32.76	e	85.0	57	17.71	n	0	37.11	e	86.0
6:15	6:39	s	57	17.71	n	0	37.11	e	86.0	57	19.04	n	0	39.63	e	86.0

Figure 8. Example (highlighted) where end time, position and depth of one watch is the same as the start time, position and depth of the next watch - this occurs because a new entry has to be made if source activity or weather conditions change, and also at least every hour as a minimum, even though you may be watching continuously. In this example source activity changed at 0615, so this is when one line of the form was completed and the next line begun.

Speed of vessel - This should be the speed over the ground at the start of the watch.

Wind force - This is recorded using the Beaufort scale of 0-12. When reading wind speed from the bridge instruments be careful to notice whether it is recorded in knots (nautical miles per hour) or metres per second. Use Table 1 to convert wind speeds measured in knots or metres per second to the Beaufort scale. Bear in mind that if the ship is heading into the wind you will need to deduct the ship's speed from the reading, and if the ship is heading with the wind you will need to add the ship's speed to the reading (ship's speed is usually measured in knots). If you need to deduct or add the ship's speed in metres per second, halving the speed in knots will give you an approximate value for the speed in metres per second. Ask the ship's officers if you need help with this.

Table 1. The Beaufort scale.

Beaufort scale	Wind speed		Description
	knots	metres per second	
0	<1	0-0.2	Calm
1	1-3	0.3-1.5	Light air
2	4-6	1.6-3.3	Light breeze
3	7-10	3.4-5.4	Gentle breeze
4	11-16	5.5-7.9	Moderate breeze
5	17-21	8.0-10.7	Fresh breeze
6	22-27	10.8-13.8	Strong breeze
7	28-33	13.9-17.1	Near gale
8	34-40	17.2-20.7	Gale
9	41-47	20.8-24.4	Severe gale
10	48-55	24.5-28.4	Storm
11	56-63	28.5-32.6	Violent storm
12	64+	32.7+	Hurricane

Sea state - There are four categories for sea state: "g" where the sea is calm, being glassy like a mirror; "s" where the sea is slight, not glassy but with no or few white caps; "c" where the sea is choppy with many white caps; and "r" where the sea is rough, with large waves, foam crests and probably some spray.

Swell height - This is measured from the trough to the crest of the swell. Categories are “o” for low (< 2 m), “m” for medium (2-4 m) and “l” for large (> 4 m).

Sun glare - The ahead categories “wf” (weak glare forward), “sf” (strong glare forward) and “vf” (variable glare forward) are used for glare in front of the beam of the vessel, while the astern categories “wb” (weak glare behind), “sb” (strong glare behind) and “vb” (variable glare behind) are used for glare behind of the beam of the vessel. See the diagram in Figure 9. The variable categories may be useful if the sun is repeatedly disappearing behind clouds and glare is therefore coming and going frequently. A new line should be entered if sun glare changes significantly and this affects your field of view, e.g. when glare crosses the beam of the vessel.

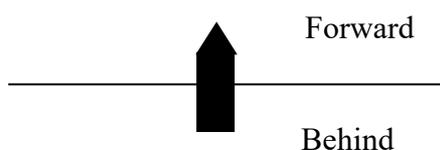


Figure 9 Position of sun glare.

Sightings

Acoustic detections as well as visual sightings may be recorded on the Sightings form. Care should be taken not to duplicate records where animals have been detected both visually and acoustically.

Sightings of mixed species can be entered with each species as a separate record (i.e. separate line) on the Sighting form, but sharing the same sighting number and/ or acoustic detection number.

Sighting number - A reference number should be given to each sighting of marine mammals, starting at 1 for the first sighting of the survey. If animals are detected acoustically but are not seen, no sighting number should be given. If animals are both seen and detected acoustically there should be both a *Sighting number* and an *Acoustic detection number*, with just one record on the Sighting form for those animals (care should be taken not to duplicate records in such cases).

Acoustic detection number - A reference number should be given to each acoustic detection of marine mammals, starting at 500 for the first acoustic detection of the survey. If animals are seen but are not detected acoustically, no acoustic detection number should be given. If animals are both seen and detected acoustically there should be both a *Sighting number* and an *Acoustic detection number*, with just one record on the Sighting form for those animals (care should be taken not to duplicate records in such cases).

Time at start of encounter - This is the time the animals were first seen, or acoustically detected.

Time at end of encounter - This is the time the animals were last seen, or acoustically detected.

How were the animals first detected - If the animals are first detected visually by you while you are watching for marine mammals you would choose category “v” - this still applies even if PAM operators subsequently detect the animals acoustically, having been alerted to their presence by the MMOs. If the animals are first seen by you but you are not actually conducting a watch at the time, or if someone else points the animals out to you, then you would choose category “i” - again, this still applies even if PAM operators subsequently detect the animals acoustically, having been alerted to their presence by the MMOs. If the animals are first detected acoustically, choose “a” -

this still applies even if the animals are subsequently seen by the MMOs, having been alerted to their presence by the PAM operators. However, if the animals are detected visually by MMOs and acoustically by the PAM operators, and each detected the animals before being informed of their presence by the other, then choose category “b”.

Position - The position should be recorded as close as possible to the start of the encounter.

Species or species group – You should not feel that you are expected to identify every sighting to species level. If definite identification is not possible, you may be able to narrow it down to a group of species. For example, if you know it's a whale not a dolphin, put “whale”. Useful categories are “whale”, “large whale”, “medium whale”, “small whale”, “dolphin”, “patterned dolphin”, “unpatterned dolphin” or groups of species of similar appearance e.g. “blue/ fin/ sei whale”, “white-beaked/ Atlantic white-sided dolphin”, “common/ Atlantic white-sided dolphin” etc. You may be able to eliminate species e.g. “medium-sized whale not killer whale”. You are free to use whatever identifications you feel are appropriate, there are no restrictions other than a limit of 60 characters.

Description - It is essential to include a description of the animal(s), even if you are certain which species it is. The identity of sightings without descriptions, or with poor descriptions, are likely to be downgraded. If you are certain which species it is, describe the characteristic features you used to identify it e.g. “hourglass pattern on flanks” for common dolphin. If you are uncertain, then the more details you describe, the better. Some features to describe are suggested on the form. For acoustic detections, the characteristics of whistles/ clicks can be described.

Bearing to animal - This is the bearing from true north, when the animal is first seen. It can be measured either with a hand-bearing compass, or by using an angleboard. If using an angleboard the line for 0° should be aligned with the vessel's heading (i.e. point ahead of the vessel). The angle to the sighting can then be added to (for animals to starboard) or subtracted from (for animals to port) the vessel's heading to ascertain the bearing to the animal. If the resulting bearing is greater than 360° subtract 360 to get the correct bearing; if the resulting bearing is a negative number add 360 to get the correct bearing. See Figure 10 for some examples of how to calculate bearing if using an angleboard. For PAM bearings with a port-starboard ambiguity it is acceptable to put both alternatives e.g. 90/270.

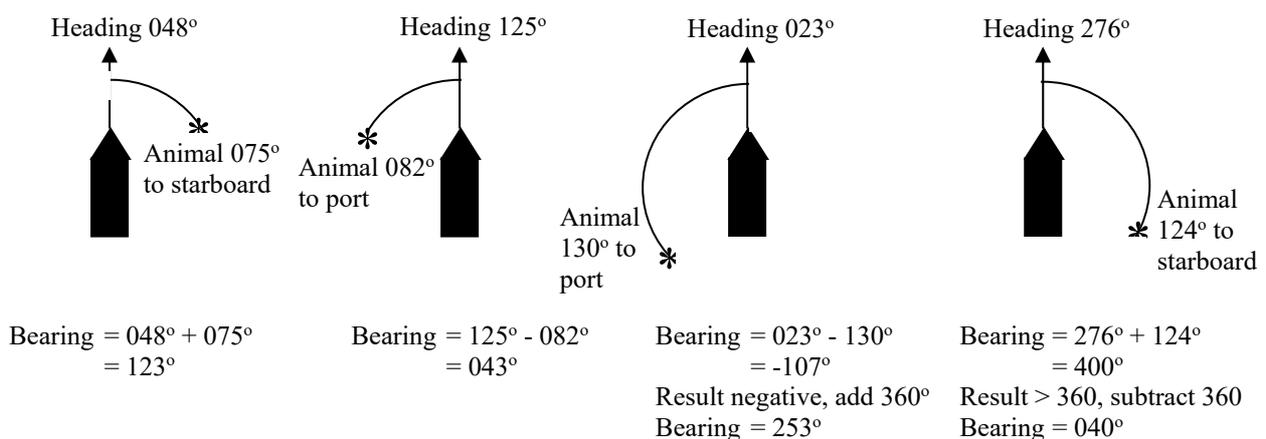


Figure 10. Examples of how to calculate the bearing from north using an angleboard and the ship's heading.

Range of animal - This is the distance of animals from the vessel at the time of first sighting.

Number of adults and *Number of juveniles* and *Number of calves* - These do not necessarily have to add up to the *Total number* (although they should not exceed it) - it may be that not all animals can be aged.

Photograph taken – If a photograph was taken a low resolution copy can be submitted with the MMO report to aid in confirming identification.

Behaviour - Record any behaviours that are apparent. Examples of behaviour are: transiting; fast swimming; slow swimming; porpoising; breaching; jumping; tail-slapping; flipper-slapping; dived; frequent surfacing; infrequent surfacing; spy-hopping; feeding; milling; logging; avoiding the ship; approaching the ship; bow-riding; swimming alongside the vessel or its equipment; altered course; social interactions; sexual behaviour; aggressive interactions; dispersed group; close group; in subgroups; or any other behaviour you see.

Direction of travel relative to ship - Diagrams to illustrate some of the categories for this field are shown in Figure 11 below. Bow-riding animals would count as “t” (travelling towards the vessel).

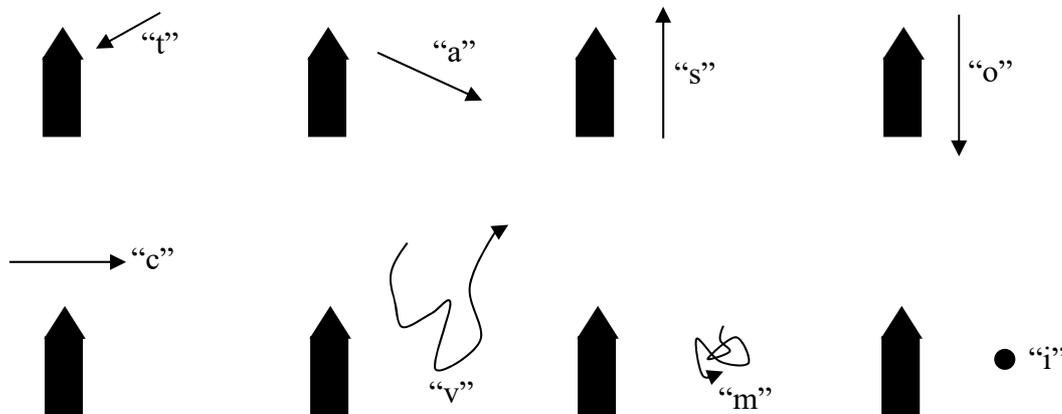


Figure 11. Examples for the different categories of direction of travel of animals relative to vessel: “t” = towards vessel; “a” = away from vessel; “s” = parallel to ship in same direction as the ship; “o” = parallel to opposite direction to the ship; “c” = crossing perpendicular ahead of the ship; “v” = variable; “m” = milling; “i” = stationary; “x” = other (not illustrated); “u” = unknown (not illustrated).

Airgun/ source activity when animals first detected and *Airgun/ source activity when animals last detected* - Make sure that the source activities recorded here correspond with those recorded on the Operations form at the appropriate times.

Time animals entered mitigation/ exclusion zone - For animals occurring in the mitigation zone/ exclusion zone (defined according to the guidelines/ regulations of the country concerned) record the time they enter or are first seen/ detected within this zone. In jurisdictions where power-downs or shut-downs are required, this information may be used to check that the source was powered down or shut down at the appropriate time to comply with the guidelines/ regulations.

Time animals left mitigation/ exclusion zone - For animals occurring in the mitigation zone/ exclusion zone (defined according to the guidelines/ regulations of the country concerned) record the time they leave or are last seen/ detected within this zone. In the event that a delay in shooting is required, this information will be used to check that the delay was of adequate duration (since the last detection in the mitigation/ exclusion zone) to comply with the guidelines/ regulations.

Closest distance of animals from airguns/ source - This is the closest distance (in metres) that the animals approach the airguns during the whole encounter and should be recorded whether or not the source is active, and whether or not the animals enter the mitigation/ exclusion zone.

First observed distance during the soft start - This field only applies for animals seen during the soft start. It is the distance the animals were from the airguns (or other source) when they were first seen during the soft start period. If they were first seen prior to the soft start commencing but were still visible when the soft start commenced this would be the distance they were from the airguns at the commencement of the soft start. If they were first seen during the soft start this would be the distance they were from the airguns when they were first seen.

Closest observed distance during the soft start - This field only applies for animals seen during the soft start. It is the closest distance that the animals approached the airguns (or other source) during the soft start period. For animals that were only seen during the soft start this would be the same as the *Closest distance of animals from airguns/ source*. For animals that were also present prior to and/ or after the soft start this may not be the same as the *Closest distance of animals from airguns/ source* if they approach closer to the airguns outside the soft start period.

Last observed distance during the soft start - This field only applies for animals seen during the soft start. It is the last distance the animals were from the airguns (or other source) during the soft start period. If the animals were only present during the soft start this would be the last distance from the airguns that they were seen at. If they were still present after the soft start this would be the distance they were from the airguns at the end of the soft start.

What action was taken - Some of the categories in this field may only apply in certain jurisdictions.

Length of power-down and/ or shut-down - This only applies in those jurisdictions where shut-downs or power-downs are required by the relevant guidelines/ regulations. This information is required to be recorded in the Gulf of Mexico, but may not be required elsewhere.

Estimated loss of production due to mitigating actions – Industry expressed a desire for this to be included, in order to assess the impact of mitigation measures upon their operations. If there has been a delay, power-down or shut-down (where these are required under the relevant guidelines/ regulations) then an estimate of any resulting loss of production should be obtained if possible from the client representative, party chief or other appropriate member of the crew.

Submission of forms:

The forms should be submitted to the relevant regulator in the country of operation. Addresses for those regulators who have indicated acceptance of these forms and their timescales for submission of reports are given below. For other regulators, reporting requirements should be checked before using these forms. The Excel spreadsheets (not the Word Deckforms) should be submitted electronically as part of the MMO report and should not be converted to pdfs, as this prevents easy importation of data into a database.

UK - Joint Nature Conservation Committee - seismic@jncc.gov.uk (as soon as possible after the survey has been completed)

Gulf of Mexico - Bureau of Safety and Environmental Enforcement - protectedspecies@bsee.gov (1st and 15th of each month, with reports of whales within the exclusion zone that resulted in shut-down of the airguns required to be submitted within 24 hours of the shut-down)

Ireland - National Parks and Wildlife Service - offshore@environ.ie (within 30 days of completion of the survey)

The International Association of Geophysical Contractors (IAGC) also recommends the use of these forms globally in the absence of government-required forms.

If the forms are attached to a report as a link, it is recommended that the Excel files are also submitted separately as the links often fail to work.

For long duration surveys, particularly where personnel may change part way through a survey, ideally one Excel file should be maintained. However, if separate files are used, please ensure that records for each period are complete and do not overlap with other periods (which would result in duplicated data).

If there is more than one MMO on board at the same time they should submit one report and set of forms between them, not a separate report for each MMO covering the same time period on the same survey.

If there has been any deviation from standard mitigation procedures in the guidelines/ regulations that has been agreed with regulators then you are encouraged to submit a documentary record of the agreement together with the forms, so that any assessment of compliance can take account of agreed deviations.