Sea Watch Foundation Database Manual

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The Cetacean Monitoring Unit

SEA WATCH

•foundation•

1. Introduction

The aim of the Sea Watch Foundation national cetacean sightings database ('the database') is to provide a central archive of cetacean sightings data from all around the UK and to manage these data so that they can be made available to answer queries on the ecology and other aspects of cetacean occurrence in the region.

The objective of this manual is to describe the structure, management system and basic use of the database. Guidelines for the collection and submission of data are provided, and the steps required to process, validate and incorporate new data into the database are explained.

2. Background

In 1973, Peter Evans formed the Cetacean Group within the UK Mammal Society in order to collect and collate sightings of cetaceans from all around the UK. A network of observers was formed, initially mainly of bird watchers, but this spread quickly to include people from all walks of life - coastguards, lighthouse keepers, fishermen, yachtsmen, and others. The interest was so great that it was difficult to process by hand all the information received. Attempts were made to standardise the recording procedures and to aid people in the identification of these potentially difficult species by production of a small guide. In 1992, following funding from the UK Department of the Environment, the Sea Watch Foundation was formed as a separate charity to extend the work of the Mammal Society Cetacean Group.

Records were initially maintained on paper, but the large number of records soon became too cumbersome to manage by hand and the first electronic version of the database was compiled using the Fortran programming language. Although this step greatly improved efficiency, the system was far from user friendly and was accessible only through command-line programming. With the development of ever more powerful and sophisticated personal computers, the database was moved onto a Filemaker Pro system running on an Apple Macintosh system. This enormously enhanced the value of the database by making it much simpler to manage and extract information. A Sightings Data Manual was compiled by Jim Heimlich-Boran (1996) to describe the structure and management of that version of the database. In summer 2000, the database was moved onto Microsoft Access running under the Windows operating system, and a number of modifications were made to its structure. A number of improvements were made to the database following its migration to Access, but in 2005 the structure of the database was completely revised.

3. Overview of the structure of the database

The structure of the database is illustrated in Figure 1, which shows a summary of the information held in each of the seven tables and the fields that form links between tables. A complete list of fields in each table and definitions of any codes used are provided in Section 5 and Appendices 1 & 2.

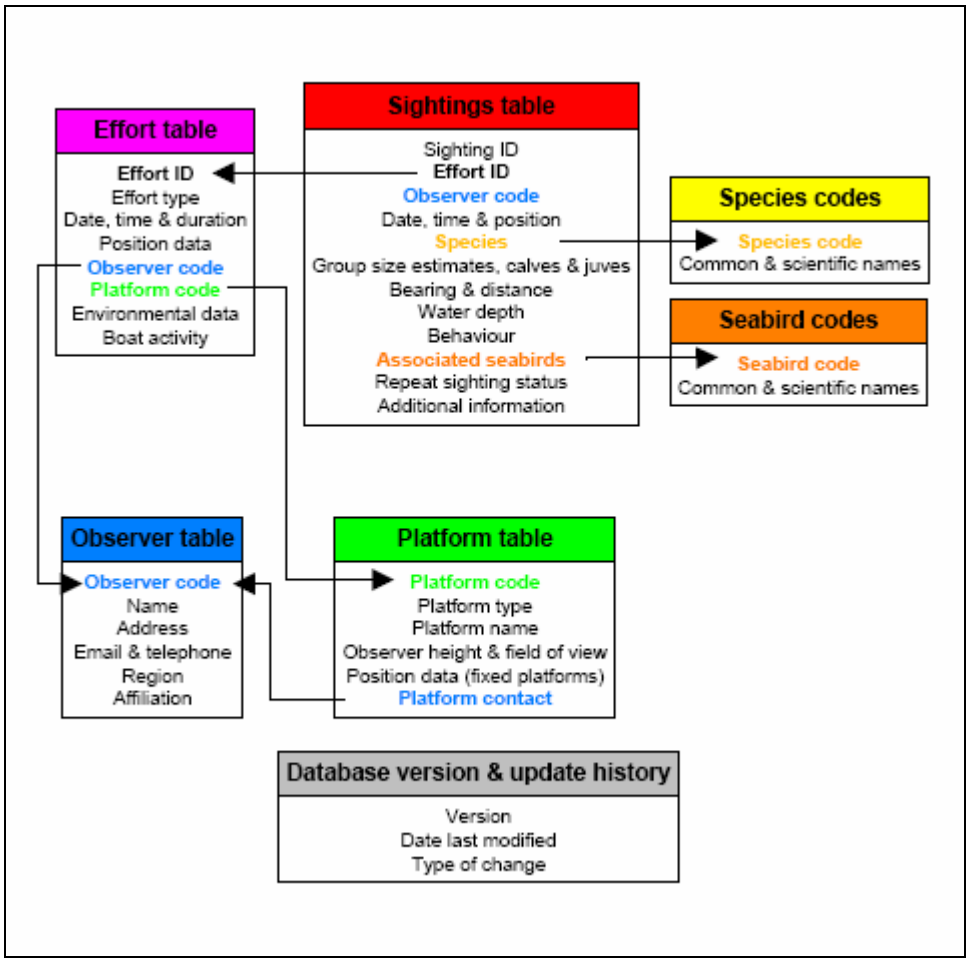

Figure 1: Diagram illustrating the structure of the Sea Watch Foundation database, showing the main tables and links between them.

The two main tables in the database are the Effort and Sightings tables. In earlier versions of the database there was considerable overlap between the two, as both tables stored environmental variables, such as sea state and visibility. This came about because sightings without any associated effort data nevertheless often had associated environmental data, hence these were stored in the Sightings table, resulting in unnecessary duplication between the tables. In the new version of the database, each sighting record is linked to an effort record, irrespective of whether or not observer effort was systematically recorded, thus doing away with the necessity of storing environmental data in the Sightings table. This change has also reduced the potential for errors in the links between the two tables, which are now much more robust.

The Effort table stores information about environmental variables that affect sighting conditions, as well as date, time and position data relating to observer effort, if these are available. A field recording the effort type distinguishes between casual sightings and data collected according to one of five main types of survey effort. The Effort table will typically be the starting point for any analyses of the data, and through this key table there are links to the Observer and Platform tables, as well as to the Sightings table.

In the Sightings table, each record is linked to an effort record. More than one sighting can be linked to a single effort record, but each sighting can only be linked to one effort record.

Every field in each record held in the database must contain a value, none are left blank, as they were in earlier versions of the database. There are appropriate codes for each field to signify that the data were not recorded or are not required (see Appendices 1 & 2).

4. The database management system

Errors are inevitable in such a large database to which so many different people have submitted and input data. A robust system for error correction and data validation is therefore extremely important. A set of validation procedures was built into the method used to translate the database into its new format. This has enforced a high degree of uniformity in the codes used for each field, completed blank fields with the appropriate codes for missing or unrecorded data, and checked the validity of the links between Sightings and Effort tables.

The path along which data flows from the original observer until it has been integrated into the database is illustrated in Figure 2, which also shows the person responsible for each stage. All new data entered into the electronic format used by the database must be validated before merging them into the main database tables. New data are not entered directly into the main database; they are input to spreadsheets that can be checked first before being merged into the main database. It is preferable to input each new set of data from one observer or group of observers, into a new spreadsheet, rather than compiling disparate sets of data together, as this will simplify the process of data checking.

New data that have been input to a spreadsheet should ideally be checked against the original paper records by someone other than the person who originally input the data. Although data are usually recorded row by row (i.e. record by record) it is often a good idea to check data column by column (i.e. field by field) as these data frequently form a sequence, making it easier to identify mistakes.

After checking for transcription errors, the electronic data are validated by a computer program that checks to ensure that each item of data is correctly formatted and has an appropriate value, and checks the links between the effort and sightings tables. The data are then plotted on a map and visually checked to make sure none fall on land or outside the expected area.

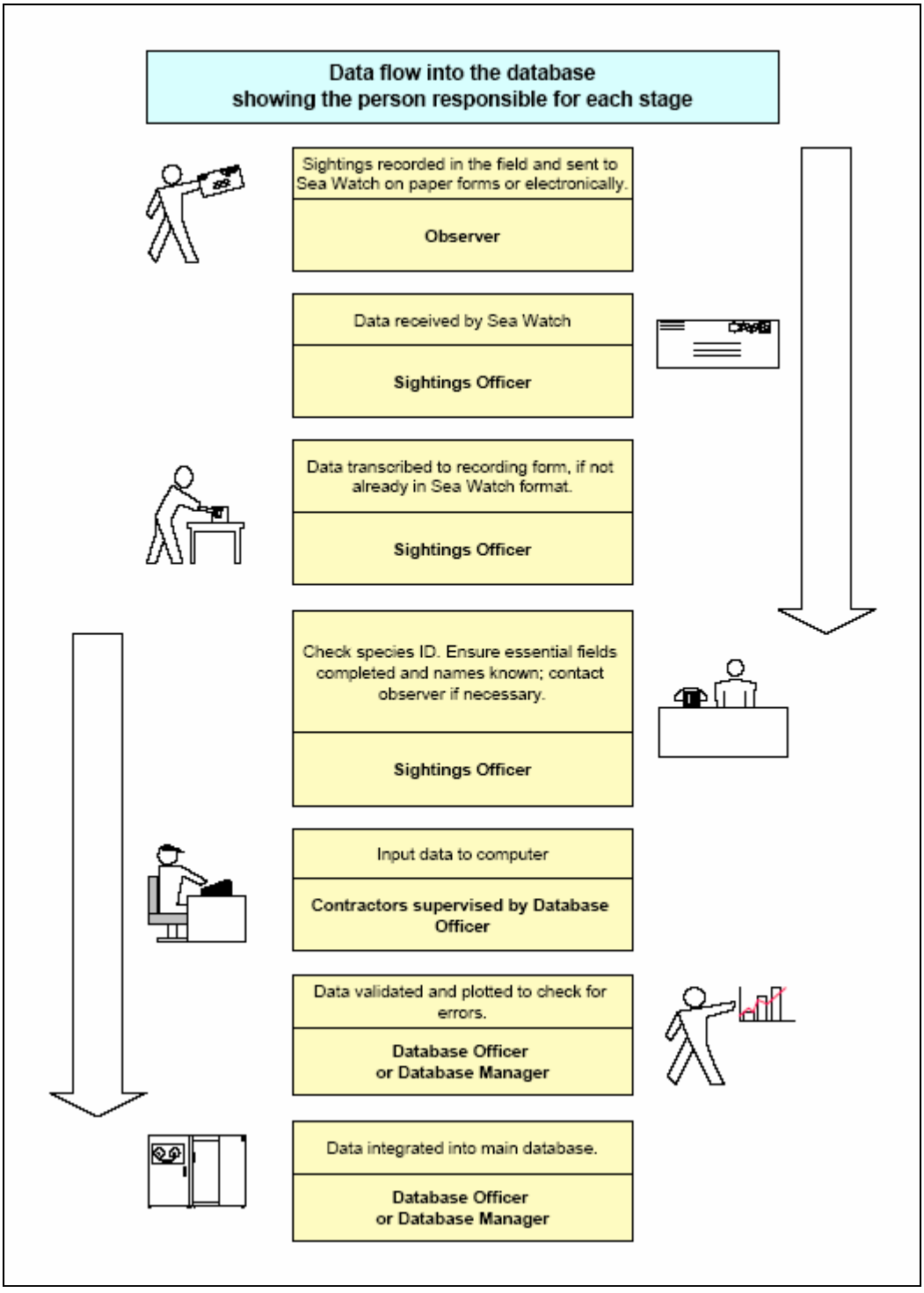

Figure 2: Diagram illustrating the path taken by data entering the database.

There are no restrictions on the number of people who input and check new data, but the resulting validated data should only be merged into the main database by the database manager or database officer. When new data are added, or any other changes made to the main database, a new record will be added to the database update history table. This table records the date and nature of each update and assigns a current version number to the database. The version history table is a safeguard against the

confusion and resulting errors that could arise from the circulation of differing copies of the database within the Sea Watch Foundation and it facilitates orderly updates and maintenance of the database.

5. Guide to data entry

Data from completed recording forms should be entered into an electronic format using Excel spreadsheets. Ready formatted Excel spreadsheets are available from Sea Watch for this purpose. These are the preferred templates to use for data entry because they follow exactly the format of the main database.

The appropriate value or code should be entered into every field, leaving no blank cells; there are codes to be used when no data are available for any given field. The data coding system is summarised in table form in Appendix 1 for the effort database and Appendix 2 for the sightings database. A full description of each field with additional guidance notes is provided below.

Note that in addition to watches or surveys for which effort recording forms have been completed, all casual sightings also require a corresponding effort record to be entered.

5.1 Effort table

Effort Field 1 Effort_ID

A unique alpha-numeric code used to identify each effort record.

Format: e*ABC123456* Example: eCW002545

Each Effort_ID code should start with a lower case “e”, followed by an upper case sequence of letters denoting the person inputting the data, followed by a number referring to that effort leg or watch. The numeric part should be padded with leading zeros so that it is 6 digits long. Note that there may be other records sharing the same numeric value but input by different people and so having a different prefix. If there is any uncertainty regarding the prefix to be used, consult the database officer for advice.

Effort Field 2 Effort_type

A four letter text code denoting the type of effort.

Format: *Text code*

Code	Description
LINE	Line transect effort with bearing and distance data collected for each sighting; at least one dedicated cetacean observer on watch.
BOAT	Mobile watch with start and end positions and times; at least one dedicated cetacean observer on watch. Used for dedicated effort from any moving vessel, including ships and smaller boats.
SKIP	Mobile watch from a vessel with start and end positions and times, but where the observer was not continuously dedicated, e.g. because they had other duties, such as navigating or driving (the SKIPper).
WILD	Mobile watch from a wildlife operator's vessel, which maximises sightings opportunities by visiting known or assumed cetacean hot-spots.
BIRD	Mobile watch from a vessel with start and end positions and times, but where the observer was primarily recording other taxa, especially seabirds.
STAT	Static watch with one position, start and end times. Most land-based watches fall in this category, but also includes watches from fixed platforms at sea. May also include estimated range and bearing data.
DIST	Point DISTANCE data, where effort was from a static platform, usually on land, and for which bearing and distance data were collected for each sighting, using a theodolite, compass or sightings board.
SCAN	Watches carried out using a scan sampling protocol, in which the number of animals seen is recorded at regular intervals (e.g. every 15 minutes) without necessarily indicating whether or not the same animals have been counted in consecutive time periods.
AERO	Mobile watch from an aircraft with start and end positions and times.
CASW	Casual watch – typically associated with a sighting with no or inadequate recorded effort.

Effort Field 3 Day

A one or two digit number from 1 to 31 representing the day in which the record was made.

Format: *Integer*

Effort Field 4 Month

A one or two digit number from 1 to 12 representing the month in which the record was made.

Format: *Integer*

Effort Field 5 Year

A four digit number representing the year in which the record was made.

Format: *Integer*

Effort Field 6 Start_time

The GMT time, using a 24 hour clock, at which the effort leg or watch period commenced.

Format: *hh:mm* Example: 15:07

In the case of a Casual Watch, enter the time of the sighting.

Note the necessity to subtract one hour from BST times to convert to GMT, i.e. 13:45 BST becomes 12:45 GMT. BST starts on the last Sunday in March and continues until the last Sunday in October (see table below).

Year	BST starts	BST ends
2003	30 March	26 October
2004	28 March	31 October
2005	27 March	30 October
2006	26 March	29 October
2007	25 March	28 October

Effort Field 7 End_time

The GMT time, using a 24 hour clock, at which the effort leg or watch period ended.

Format: *hh:mm* Example: 16:00

In the case of a Casual Watch, enter the time of the sighting.

Note the necessity to subtract one hour from BST times to convert to GMT (see Effort Field 6).

Effort Field 8 Duration

An integer representing the number of minutes the effort leg or watch period lasted.
In the case of a Casual Watch enter 1.

Format: *Integer*

Note, this should be formatted as a plain number, not as a time. The Excel spreadsheets supplied for data input will include a formula for calculating this field automatically.

Effort Field 9 Lat_start

The latitude at the start of the watch period or effort leg.

Format: *Decimal degrees* Example: 52.4875

In the case of a Casual Watch, enter the latitude of the sighting.

Note: Position data are held in the database as latitude and longitude co-ordinates, formatted in decimal degrees. **However, in the spreadsheets prepared for data entry, positions are entered as degrees and decimal minutes**: these will be converted later into decimal degrees. This means that there are two columns for latitude in the data entry spreadsheets, one for degrees, the other for minutes, as shown in the following example:

Data entry spreadsheet: Lat_start_degrees

Format: *Integer* Example: 52

Data entry spreadsheet: Lat_start_minutes

Format: *Decimal minutes* Example: 27.56

For help on converting from minutes and seconds to decimal minutes, see the last section in Appendix 6.

Effort Field 10 Lon_start

The longitude at the start of the watch period or effort leg.

Format: *Decimal degrees* Example: -4.5643

In the case of a Casual Watch, enter the longitude of the sighting.

Note: Position data are held in the database as latitude and longitude co-ordinates, formatted in decimal degrees. **However, in the spreadsheets prepared for data entry, positions are entered as degrees and decimal minutes**: these will be converted later into decimal degrees. This means that there are three columns for longitude in the data entry spreadsheets, one for degrees, one for minutes, and a third to indicate whether the position is west or east of the Greenwich meridian, as shown in the following example:

Data entry spreadsheet: Lon_start_degrees

Format: *Integer* Example: 2

Data entry spreadsheet: Lon_start_minutes

Format: *Decimal minutes* Example: 27.56

For help on converting from minutes and seconds to decimal minutes, see the last section in Appendix 6.

Data entry spreadsheet: Lon_start_meridian

Format: *E or W* Example: W

Effort Field 11 Lat_end

The latitude at the end of the watch period or effort leg.

Format: *Decimal degrees* Example: 52.4875

In the case of a Casual Watch, enter the latitude of the sighting. For watches from static platforms, this will have the same value as Lat_start.

Note: Position data are held in the database as latitude and longitude co-ordinates, formatted in decimal degrees. **However, in the spreadsheets prepared for data entry, positions are entered as degrees and decimal minutes**: these will be converted later into decimal degrees. This means that there are two columns for latitude in the data entry spreadsheets, one for degrees, the other for minutes, as shown in the following example:

Data entry spreadsheet: Lat_end_degrees

Format: *Integer* Example: 52

Data entry spreadsheet: Lat_end_minutes

Format: *Decimal minutes* Example: 27.56

For help on converting from minutes and seconds to decimal minutes, see the last section in Appendix 6.

Effort Field 12 Lon_end

The longitude at the end of the watch period or effort leg.

Format: *Decimal degrees* Example: -4.5643

In the case of a Casual Watch, enter the longitude of the sighting. For watches from static platforms, this will have the same value as Lon_start.

Note: Position data are held in the database as latitude and longitude co-ordinates, formatted in decimal degrees. **However, in the spreadsheets prepared for data entry, positions are entered as degrees and decimal minutes**: these will be converted later into decimal degrees. This means that there are three columns for

longitude in the data entry spreadsheets, one for degrees, one for minutes, and a third to indicate whether the position is west or east of the Greenwich meridian, as shown in the following example:

Data entry spreadsheet: Lon_end_degrees

Format: *Integer* Example: 2

Data entry spreadsheet: Lon_end_minutes

Format: *Decimal minutes* Example: 27.56

For help on converting from minutes and seconds to decimal minutes, see the last section in Appendix 6.

Data entry spreadsheet: Lon_end_meridian

Format: *E or W* Example: W

Effort Field 13 Geog_accuracy

A numeric code indicating the accuracy of the latitude and longitude position data.

Format: *Integer* Example: 1

Code	Description
5	Accurate to within 50km (only the general area known)
4	Accurate to within 5km (e.g. estimated from time along a ferry route)
3	Accurate to within 1.5km (e.g. position estimated from land marks or by dead-reckoning)
2	Accurate to within 150m (e.g. pre1999 GPS)
1	Accurate to within 50m (e.g. post 1999 GPS recorded in DMS or degrees and decimal minutes)
0	Not known

Effort Field 14 Observer

The observer code; forms a link to the Observer table.

Format: *Integer* Example: 5006

This should normally reference the observer or watch leader if more than one observer was involved. Do not enter more than one observer code.

Effort Field 15 Platform_type

A four letter code denoting the type of platform from which the record was made.

Format: *Text code*

Code	Description
LAND	Any land based platform, including headlands, islands, piers and towers.
RIGS	A static platform at sea, including oil rigs and moored vessels.
AERO	Aircraft, including fixed wing, helicopters, microlites and balloons.
SAIL	Vessel under sail, not including yachts running on engine power.
KYAK	Canoes, rowing boats and anything paddled, e.g. wave skies.
MOBO	Small motorboat, less than 15 m length.
MEMO	Medium sized motor powered vessel, from 15 m to 30 m.
SHIP	Ship, a motor vessel more than 30 m in length.
FERY	Ferry of conventional type.
CATS	High speed ferry.
UNVE	Vessel of unknown size or type.
NOPL	Platform type unknown.

Note that for yachts, which may operate alternately under wind or engine power, this field should be set accordingly to SAIL or MOBO / MEDB for each effort leg, while retaining the same Platform_code (Field 16).

Effort Field 16 Platform_code

An alpha-numeric code that forms a link to the Platform table.

Format: *AB123* Example: LA023

These codes have been left unchanged from earlier versions of the database. Therefore, although the prefix denotes platform type, this will not be the same as the value in Platform_type (Field 15), because platform type codes have been changed. The numeric part should be padded with leading zeros to make it 3 digits long.

Note: It is important to bear in mind that a platform code refers to an observation platform, rather than a general location or a vessel. This is because there may be more than one platform with different characteristics, used by observers on one headland, island or ship. For example, on a vessel there may be one platform in the crow's nest 15 m above sea level, and another on a lower deck only 2 m above sea level. These should each have been assigned a separate platform code.

Effort Field 17 Wind_force

A number from 0 to 10 representing wind force on the Beaufort scale.

Format: *Integer*

If wind force was not recorded, enter -1 (minus one).

Wind speeds measured in knots, mph, kph etc should be converted to the appropriate Beaufort scale category (see table below).

Beaufort	Knots	Miles / hour	Kilometres / hour
0	<1	<1	<1
1	1-3	1-4	1-5
2	4-6	5-7	6-11
3	7-10	8-11	12-19
4	11-16	12-18	20-29
5	17-21	19-24	30-39
6	22-27	25-31	40-50
7	28-33	32-38	51-61
8	34-40	39-46	62-74
9	41-47	47-54	75-87
10	48-55	55-63	88-102

Effort Field 18 Wind_direction

The compass direction **from** which the wind was blowing.

Format: *Text code*

Code	Description	Range in degrees
N	North	340 - 22
NE	North-east	23 - 67
E	East	68 - 112
SE	South-east	113 - 157
S	South	158 - 202
SW	South-west	203 - 247
W	West	248 - 292
NW	North-west	292 - 339
VAR	Variable	No particular direction
NR	Not recorded	-

Effort Field 19 Sea_state

A number representing sea state on the Beaufort scale

Format: *Numeric*

Although strictly speaking the Beaufort scale refers to categories, and should therefore be represented by whole-number values, some observers use intermediate values, in which case increments of 0.5 are permissable. Thus when sea state has been recorded as a range, e.g. 2 – 3, this can be entered as 2.5.

If sea state was not recorded, enter -1 (minus one).

Effort Field 20 **Swell_height**

A text code denoting swell height categories.

Format: *Text code*

Code	Description	Height in metres
N	None	0
L	Low	< 1 m
M	Medium	1 to 2 m
H	High	> 2 m
NR	Not recorded	-

Effort Field 21 **Precip_type**

A text code denoting precipitation types.

Format: *Text code*

Code	Description
N	None
R	Rain
SN	Snow
F	Fog / mist
H	Hail
SL	Sleet
NR	Not recorded

Effort Field 22 **Precip_intensity**

A text code denoting precipitation types.

Format: *Text code*

Code	Description
CL	Continuous light
CH	Continuous heavy
IL	Intermittent light
IH	Intermittent heavy
CM	Continuous moderate
IM	Intermittent moderate
NR	Not recorded

Effort Field 23 Visibility

A numeric code denoting visibility over the sea surface.

Format: *Numeric code in the range* 0 - 3

Code	Description	Visibility in km
0	Not recorded	?
1	Poor	< 1 km
2	Moderate or fair	1 to 5 km
3	Good	6 to 10 km
4	Excellent	> 10 km

Effort Field 24 Boat_activity

A text code or codes listing boat activity visible in the area at the time of effort.

Format: *Text code with numeric prefix; comma and space separated list of codes.*

Example: 1YA, 2FI (One yacht and two fishing boats)

Code	Description
NB	None – no boats in the area.
YA	Yacht or sailing boat
RB	Rowing boat, kayak or other paddled craft.
JS	Jet ski
SB	Speed boat, RIB or other small fast motorboat.
MB	Motorboat.
FI	Fishing boat.
FE	Ferry.
LS	Large ship (> 30 m length).
VE	Unspecified vessel.
SV	Seismic survey vessel.
WS	Warship.
NR	Boat activity not recorded.

Prefix the text code with the number of boats recorded (e.g. 2 fishing boats = 2FI). If more than one type of boat was recorded, list the types separated by a comma and a space (e.g. 1 yacht and 2 fishing boats = 1YA, 2FI).

Effort Field 25 Additional_information

A text field for comments or links to additional information collected with the effort record.

Format: *Text*

5.2 Sightings table

Sightings Field 1 Sighting_ID

A unique alpha-numeric code used to identify each sighting record.

Format: s*ABC123456* Example: sCW002545

Each Sighting_ID code should start with a lower case "s", followed by an upper case sequence of letters denoting the person inputting the data, followed by a number referring to that sighting. The numeric part should be padded with leading zeros so that it is 6 digits long. Note that there may be other records sharing the same numeric value but input by different people and so having a different prefix. If there is any uncertainty regarding the prefix to be used, consult the database officer for advice.

Sightings Field 2 Assoc_effort_ID

An alpha-numeric code that links the sighting record to its associated effort record.

Format: e*ABC123456* Example: eCW002545

This is the Effort_ID code of the record in which the effort data associated with this sighting are stored.

Note: All sightings records must have a link to a corresponding effort record, even in the case of casual sightings. This is because environmental data are stored in the effort record.

Sightings Field 3 Observer

The observer code; forms a link to the Observer table.

Format: *Integer* Example: 5006

This should reference the observer who first made the sighting. Note that this can differ from the observer referenced by the associated effort record when more than one observer was involved in the watch or survey. Do not enter more than one observer code.

Sightings Field 4 Day

A one or two digit number from 1 to 31 representing the day in which the record was made.

Format: *Integer*

Sightings Field 5 Month

A one or two digit number from 1 to 12 representing the month in which the record was made.

Format: *Integer*

Sightings Field 6 Year

A four digit number representing the year in which the record was made.

Format: *Integer*

Sightings Field 7 Time_start

The GMT time, using a 24 hour clock, when the animal(s) were first seen.

Format: *hh:mm* Example: 15:07

Note the necessity to subtract one hour from BST times to convert to GMT, i.e. 13:45 BST becomes 12:45 GMT. BST starts on the last Sunday in March and continues until the last Sunday in October (see table below).

Year	BST starts	BST ends
2003	30 March	26 October
2004	28 March	31 October
2005	27 March	30 October
2006	26 March	29 October
2007	25 March	28 October

Sightings Field 8 Time_end

The GMT time, using a 24 hour clock, when the animal(s) were last seen.

Format: *hh:mm* Example: 16:00

In many cases only one time will have been recorded, in which case the time of the sighting should also be entered here.

Note the necessity to subtract one hour from BST times to convert to GMT (see Sightings Field 7, above).

Sightings Field 9 Species

Text code that identifies the species; links to Species table.

Format: *Text code*

Species codes are listed in Appendix 3. Only codes listed in the Species table may be used. Note that there are also codes for unidentified species and cases where identification could only be narrowed down to a number of similar species.

Sightings Field 10 Best_est_group

The best estimate of group size.

Format: *Integer*

If group size was not recorded, enter 1.

Enter a single value, not a range. If a range has been recorded, e.g. 10 – 12, then enter the median value, in this case 11. Round up if necessary, e.g. if the range is 10 – 15, enter 13.

Sightings Field 11 Min_no

The minimum estimate of group size.

Format: *Integer*

If not recorded = -1 (minus one)

If a range has been recorded for group size, e.g. 10 – 12, then enter the lower value, in this case 10.

Sightings Field 12 Max_no

The maximum estimate of group size.

Format: *Integer*

If not recorded = -1 (minus one)

If a range has been recorded for group size, e.g. 10 – 12, then enter the higher value, in this case 12.

Sightings Field 13 No_calves

The estimated number of calves in the group.

Format: *Integer*

If not recorded = -1 (minus one)

Note the difference between a sighting in which no calves were thought to be present, where No_calves = 0, and a sighting in which it was not possible to determine whether or not calves were present, or calves were overlooked, in which case No_calves = -1.

For a definition of a calf, see the *Sea Watch Foundation Cetacean Recording Manual*.

Sightings Field 14 No_juveniles

The estimated number of juveniles in the group.

Format: *Integer*

If not recorded = -1 (minus one)

Note the difference between a sighting in which no juveniles were thought to be present, where No_juveniles = 0, and a sighting in which it was not possible to determine whether or not juveniles were present, or juveniles were overlooked, in which case No_juveniles = -1.

For a definition of a juvenile, see the *Sea Watch Foundation Cetacean Recording Manual*.

Sightings Field 15 Latitude

The latitude of the sighting.

Format: *Decimal degrees* Example: 52.4875

Note: Position data are held in the database as latitude and longitude co-ordinates, formatted in decimal degrees. **However, in the spreadsheets prepared for data entry, positions are entered as degrees and decimal minutes**: these will be converted later into decimal degrees. This means that there are two columns for latitude in the data entry spreadsheets, one for degrees, the other for minutes, as shown in the following example:

Data entry spreadsheet: Lat_degrees

Format: *Integer* Example: 52

Data entry spreadsheet: Lat_minutes

Format: *Decimal minutes* Example: 27.56

For help on converting from minutes and seconds to decimal minutes, see the last section in Appendix 6.

Sightings Field 16 Longitude

The longitude of the sighting.

Format: *Decimal degrees* Example: -4.5643

Note: Position data are held in the database as latitude and longitude co-ordinates, formatted in decimal degrees. **However, in the spreadsheets prepared for data entry, positions are entered as degrees and decimal minutes**: these will be converted later into decimal degrees. This means that there are three columns for longitude in the data entry spreadsheets, one for degrees, one for minutes, and a third to indicate whether the position is west or east of the Greenwich meridian, as shown in the following example:

Data entry spreadsheet: Lon_degrees

Format: *Integer* Example: 2

Data entry spreadsheet: Lon_minutes

Format: *Decimal minutes* Example: 27.56

For help on converting from minutes and seconds to decimal minutes, see the last section in Appendix 6.

Data entry spreadsheet: Lon_meridian

Format: *E or W* Example: W

Sightings Field 17 Geog_accuracy

A numeric code indicating the accuracy of the latitude and longitude position data.

Format: *Integer* Example: 1

Code	Description
7	Accurate to within 50km (only the general area known).
6	Accurate within 10km (e.g. estimated from time along a ferry route).
5	Accurate to within 5km (e.g. rough estimation of position or no distance and bearing to big whale).
4	Accurate within 2km (e.g. from land but no distance and bearing).
3	Accurate to within 1km (e.g. GPS of vessel; or from land estimated distance to animals > 1000m).
2	Accurate within 500m (e.g. GPS of vessel + distance and bearing but animals > 1000m).
1	Accurate within 50m (e.g. GPS + precise estimates of range and bearing).
0	Not known

Note that we wish to record the position of the sighting in the database, rather than the position of the observer. Thus if only the position of the observer is known with no indication of how far away the animals were seen, the geographical accuracy code of the sighting should be no better than 4.

Sightings Field 18 Bearing

The compass bearing from the observer to the animal(s).

Format: *Integer* in the range 0 – 360.

If not recorded = -1 (minus one)

This should be the true bearing from the observer to the sighting. If an angle board was used in the field to record the angle of the sighting from the bow of a vessel, then the bearing should be calculated using the heading of the vessel at the time of the sighting.

Sightings Field 19 Distance

The estimated distance in metres from the observer to the animal(s).

Format: *Numeric*.

If not recorded = -1 (minus one)

This should be the estimated distance from the observer to the animal(s) at the time when they were first seen.

Sightings Field 20 Depth

The water depth at the location of the sighting, measured by an echo-sounder.

Format: *Numeric*.

If not recorded = -1 (minus one)

Sightings Field 21 Animal_heading

The compass direction **towards** which the animal(s) were moving.

Format: *Text code*

Code	Description	Range in degrees
N	North	340 - 22
NE	North-east	23 - 67
E	East	68 - 112
SE	South-east	113 - 157
S	South	158 - 202
SW	South-west	203 - 247
W	West	248 - 292
NW	North-west	293 - 339
VAR	Variable	No particular direction
NR	Not recorded	-

Only one direction should be entered, representing what was considered to be the overall heading of the animals.

Sightings Field 22 Behaviour_1

Text code indicating the most frequently observed behaviour category during the sighting.

Format: *Text code*

Code	Behaviour	Notes
SURF	Surfacing	A "catch all" category that covers all cases when animals are only seen surfacing without any other obvious behaviour.
NORM	Normal swimming	Typically a sequence of 2 or more surfacing events seen, indicating movement through the water at a normal speed.
FAST	Fast swimming or porpoising	Usually involves some splashing, or cases where animals are seen to rush through the surface creating some white water. In any event, they appear to be swimming faster than normal.
BLOW	Blowing	Typically applied when the only observation made is a blow.
FEED	Feeding or foraging	Should be reserved for cases in which some evidence for feeding has been seen, e.g. fish or other prey have been seen, associated seabirds were seen diving amongst the animals, or baleen whales were seen taking in large mouthfuls of water and straining it.
JUMP	Full or partial breach or leap	Breaching or leaping involves a substantial part or all of an animal leaving the water.
SLAP	Tail slap	An animal deliberately smacks the surface of the sea with its tail fluke.
HEAD	Spy hop	Raising the head more or less vertically out of the water so that the animal can see above the water.
WAVE	Bow riding	Includes riding other waves close to the vessel, e.g. alongside the stern.
REST	Lying still on surface	Resting or lying still on the surface, or very slow movement.
SEXY	Sexual behaviour	Involves at least 2 animals which appear to interact in close physical proximity; males with erections.
AGRO	Aggression	Aggressive behaviour between 2 or more animals, e.g. biting, ramming etc.
NOTR	Not recorded	Behaviour was not recorded.

Sightings Field 23 Behaviour_2

Text code indicating the second most frequently observed behaviour category during the sighting.

Format: *Text code*

See Sightings Field 21 above for list of codes.

Sightings Field 24 Reaction

Text code indicating the reaction of the animal(s) to ships or boats (including the survey vessel, if appropriate).

Format: *Text code*

Code	Description
POS	Attracted to the vessel, e.g. changed direction of movement towards the vessel or came to bow ride.
NEG	Avoided the vessel, e.g. seen to change heading away from the vessel.
NON	No response seen, although there was a boat in the vicinity.
NR	Reaction was not recorded or no boats in the vicinity.

Sightings Field 25 Assoc_birds

Text code indicating the species of birds associating with the sighted animal(s).

Format: *Text code with numeric prefix if more than one; comma and space separated list of codes.*

See Appendix 4 for a list of seabird species codes.

In many cases, observers may simply record one seabird species, giving no indication of numbers. Where counts of seabirds have been recorded, the number should be prefixed to the species code, e.g. 100 gannets = 100GA. If more than one species was recorded, make a list of codes (including numeric prefixes if appropriate), separating items in the list by a comma and a space, e.g. 10 gannets and 5 Manx shearwaters = 10GA, 5MS.

Sightings Field 26 Repeat_sighting

Alpha-numeric code indicating whether or not this record represents a repeat sighting of the same animals recorded in an immediately prior sighting.

Format: *N* or s*ABC123456* Example: sCW002545

N = This is the first sighting of this animal or group.
s*ABC123456* = This is a repeat sighting of the animal(s) first seen in sighting s*ABC123456*.

Repeat sightings only refer to cases when a series of sighting records were made in sequence. It does not apply to cases when a sighting was made later in the day and there were reasons to believe that the animals were the same individuals as those seen

earlier – such records should be treated as new sightings and assigned the value 0 here.

Sightings Field 27 Additional_information

A text field for comments or links to additional information collected with the sighting record.

Format: *Text*

5.3 Observer table

Observers Field 1 Observer_code

Unique number for each observer or group of observers.

Format: *Integer*

Observers Field 2 First_name

The observer's first name.

Format: *Text*

This does not need to be formal, but should usually be the name by which the observer is commonly known.

Observers Field 3 Last_name

The observer's last name.

Format: *Text*

Observers Field 4 Mailing_name

The observer's full name with title, as used in a mail address.

Format: *Text* Example: Dr P.G.H. Evans

Observers Field 5 Address1

The first line of the observer's postal address.

Format: *Text*

Observers Field 6 **Address2**

The second line of the observer's postal address.

Format: *Text*

Observers Field 7 **Address3**

The third line of the observer's postal address.

Format: *Text*

Observers Field 8 **Town_city**

The town or city of the observer's postal address.

Format: *Text*

Observers Field 9 **Post_code**

The observer's post code.

Format: *Text*

Observers Field 10 **Country**

The country of the observer's postal address.

Format: *Text*

Observers Field 11 **E-mail**

The observer's e-mail address.

Format: *Text*

Observers Field 12 **Telephone**

The observer's (landline) telephone number.

Format: *Numeric*

This should include dialling codes.

Observers Field 13 Mobile

The observer's mobile telephone number.

Format: *Numeric*

Observers Field 14 Region

The Sea Watch region in which the observer lives or is mainly active.

Format: *Text*

Note: Some observers may not be strongly associated with any one region, so they may be assigned a roving category.

Observers Field 15 Affiliation

The organisation, institution or group (if any) with which the observer is affiliated.

Format: *Text*

5.4 Platform table

Platforms Field 1 Platform_code

A unique alpha-numeric cde to identify the platform.

Format: *Text* Example: VE001

Most existing platform codes have been left unaltered from earlier versions of the database. They consist of one or more letters denoting the platform type, followed by a numeric suffix. The number should be padded with leading zeros so that it is 3 digits long.

Note that it will be necessary to assign more than one platform code (and therefore more than one complete record in the platform table) for a vessel if there are more than one observation platforms associated with that vessel. The same is true for sailing boats that sometimes run on engine power, one record should be completed for it as a sailing vessel, and another as a motor vessel.

Platforms Field 2 Platform_type

A four letter code denoting platform type.

Format: *Text code*

Code	Description
LAND	Any land based platform, including headlands, islands, piers and towers.
RIGS	A static platform at sea, including oil rigs and moored vessels.
AERO	Aircraft, including fixed wing, helicopters, microlites and baloons.
SAIL	Vessel under sail, not including yachts running on engine power.
KYAK	Canoes, rowing boats and anything paddled, e.g. wave skies.
MOBO	Small motorboat, less than 15 m length.
MEMO	Medium sized motor powered vessel, from 15 m to 30 m.
SHIP	Ship, a vessel more than 30 m in length.
FERY	Ferry of conventional type.
CATS	High speed ferry
UNVE	Vessel of unknown size or type
NOPL	Platform unknown

Platforms Field 3 Platform_name

The name of the place, vessel or platform.

Format: *Text*

Platforms Field 4 Obs_height

The eye-height in metres above sea level of an observer on the platform.

Format: *Numeric*

For land platforms which are relatively high above sea level, this should simply be the height of the location above sea level, e.g. as read from an Ordnance Survey map. For boats and ships, eye height should be measured as accurately as possible for an observer in the usual observation position. If there are more than one observation positions with differing heights, e.g. wheel-house deck and crow's nest, then these should each be assigned their own platform codes. Similarly, if observations are sometimes carried out from an inflatable or tender launched from a larger vessel, then a separate platform code should be assigned to the smaller boat.

Platforms Field 5 Field_of_view

The unobstructed field of view in degrees for an observer on the platform.

Format: *Numeric up to 360*

Platforms Field 6 Latitude

The latitude of a fixed platform.

Format: *Decimal degrees* Example: 52.4875

For an explanation of how to convert from degrees and minutes to decimal degrees, see note in Lat_start, Effort Field 9.

Platforms Field 7 Longitude

The longitude of a fixed platform.

Format: *Decimal degrees* Example: -2.4875

For an explanation of how to convert from degrees and minutes to decimal degrees, see note in Lat_start, Effort Field 9.

Platforms Field 8 Platform_contact

Link to the Observer table, referencing the main contact person for the platform.

Format: *Integer*

Appendices

Appendix 1: Data Codes for the Effort Database
Appendix 2: Data Codes for the Sightings Database
Appendix 3: Species Codes
Appendix 4: Associated Bird Species Codes
Appendix 5: Recording forms.
Appendix 6: Notes about latitude and longitude

Appendix 1: Data Codes for the Effort Database

Field Name	Code	Variable
Effort_ID	Text	Unique identifier for effort records, e.g. eCW000123
Effort_type	LINE	Line transect effort with bearing and distance data collected for each sighting; at least one dedicated cetacean observer on watch.
	BOAT	Mobile watch with start and end positions and times; at least one dedicated cetacean observer on watch. Used for dedicated effort from any moving vessel, including ships and smaller boats.
	SKIP	Mobile watch from a vessel with start and end positions and times, but where the observer was not continuously dedicated, e.g. because they had other duties, such as navigating or driving (the SKIPper).
	WILD	Mobile watch from a wildlife operator's vessel, which maximises sightings opportunities by visiting known or assumed cetacean hot-spots.
	BIRD	Mobile watch from a vessel with start and end positions and times, but where the observer was primarily recording other taxa, especially seabirds.
	STAT	Static watch with one position, start and end times. Most land-based watches fall in this category, but also includes watches from fixed platforms at sea. May also include estimated range and bearing data.
	DIST	Point DISTANCE data, where effort was from a static platform, usually on land, and for which bearing and distance data were collected for each sighting, using a theodolite, compass or sightings board.
	SCAN	Watches carried out using a scan sampling protocol, in which the number of animals seen is recorded at regular intervals (e.g. every 15 minutes) without necessarily indicating whether or not the same animals have been counted in consecutive time periods.
	AERO	Mobile watch from an aircraft with start and end positions and times.
	CASW	Casual watch – typically associated with a sighting with no or inadequate recorded effort.
Day	Dd	Day in which record was made
Month	mm	Month in which record was made
Year	yyyy	Year in which record was made
Start_time	hh:mm	GMT time at start of watch/leg
End time	hh:mm	GMT time at end of watch/leg
Duration	Numeric	Duration of watch or leg in minutes
Lat_start	Numeric	Latitude at start of watch/leg expressed in decimal degrees (usually to 4 decimal places).
Long_start	Numeric	Longitude at start of watch/leg expressed in decimal degrees (usually to 4 decimal places).

Effort Database (continued)

Field Name	Code	Variable
Lat_end	Numeric	Latitude at end of watch/leg expressed in decimal degrees (usually to 4 decimal places).
Long_end	Numeric	Longitude at end of watch/leg expressed in decimal degrees (usually to 4 decimal places).
Geog_accuracy	5	Accurate to within 50km (only general area known)
	4	Accurate to within 5km (e.g. estimated from time along ferry route)
	3	Accurate within 1.5km (position estimated from land marks or by dead-reckoning)
	2	Accurate within 150m (pre1999 GPS)
	1	Accurate within 50m (e.g. post 1999 GPS recorded in DMS or degrees and decimal minutes)
	0	Not known
Observer	Integer	Link to Observer table
Platform_type	LAND	Any land based platform, including headlands, islands, piers and towers.
	RIGS	A static platform at sea, including oil rigs and moored vessels.
	AERO	Aircraft, including fixed wing, helicopters, microlites and baloons.
	SAIL	Vessel under sail, not including yachts running on engine power.
	KYAK	Canoes, rowing boats and anything paddled, e.g. wave skies.
	MOBO	Small motorboat, less than 15 m length.
	MEMO	Medium sized motor powered vessel, from 15 m to 30 m.
	SHIP	Ship, a motor vessel more than 30 m in length.
	FERY	Ferry of conventional type.
	CATS	High speed ferry.
	UNVE	Vessel of unknown size or type.
	NOPL	Platform type unknown.
Platform_code	Text	Link to Platform table
Wind_force	0 – 10	Beaufort scale
	-1	Not recorded
Wind_direction	N, NE etc	Compass points
	VAR	Variable
	NR	Not available
Sea_state	0 – 10	Beaufort scale (Intermediate values permissable if range given, e.g. if 2 – 3 recorded, enter 2.5).
	-1	Not recorded

Effort Database (continued)

Field Name	Code	Variable
Swell_height	N	None 0
	L	Low < 1 m
	M	Medium 1 to 2 m
	H	High > 2 m
	NR	Not recorded
Precip_type	N	None
	R	Rain
	SN	Snow
	F	Fog/mist
	H	Hail
	SL	Sleet
	NR	Not recorded
Precip_intensity	CL	Continuous light
	CH	Continuous heavy
	IL	Intermittent light
	IH	Intermittent heavy
	CM	Continuous moderate
	IM	Intermittent moderate
	NR	Not recorded
Visibility	0	Not recorded
	1	Less than 1km/at night
	2	1-10 km (moderate/fair)
	3	More than 10 km (good/excellent)
Boat_activity	NB	None – no boats in the area
	YA	Yacht / sailing boat
	RB	Rowing boat, kayak etc
	JS	Jet ski
	SB	Speed boat / RIB / small fast motorboat
	MB	Motorboat
	FI	Fishing boat
	FE	Ferry
	LS	Large ship (> 30m in length)
	VE	Unspecified vessel
	SV	Seismic survey vessel
	WS	Warship
	NR	Not recorded
		NB Prefix code with number without a space between, e.g. 3YA. If more than 1 type of boat, make a list with comma followed by space between codes, e.g. 3YA, 1LS
Additional_information	Text	Comments or link to other recorded information.

Appendix 2: Data Codes for the Sightings Database

Field Name	Code	Variable
Sighting_ID	Text	Unique identifier for sighting record, e.g. sCW000123
Assoc_effort_ID	Text	Link to effort record, e.g. eCW002545
Observer	Integer	Link to Observer table
Day	dd	Date of observation
Month	mm	Month of observation
Year	yyyy	Year of observation
Time_start	hh:mm	Time of observation
Time_end	hh:mm	Time last seen. Same as Time_start if not recorded as end time of sighting.
Species	Text	Link to Species code table (see Appendix 3).
Best_est_group	Integer	Best estimate of number of animals – median value if range given (round up if necessary). If not recorded = 1.
Min_no	Integer	Minimum estimate of number of animals
	-1	Not recorded
Max_no	Integer	Maximum estimate of number of animals
	-1	Not recorded
No_calves	Integer	Number of calves within the group
	-1	Not recorded
No_juveniles	Integer	Number of juveniles within the group
	-1	Not recorded
Latitude	Numeric	Decimal degrees (usually to 4 decimal places)
Longitude	Numeric	Decimal degrees (usually to 4 decimal places)
Geog_accuracy	7	Accurate to within 50km (only general area known).
	6	Accurate to within 10km (e.g. estimated from time along ferry route).
	5	Accurate to within 5km (e.g. rough estimation of position or no distance and bearing to big whale).
	4	Accurate within 2km (e.g. from land but no distance and bearing).
	3	Accurate to within 1km (e.g. GPS of vessel; or from land estimated distance to animals > 1000m).
	2	Accurate within 500m (e.g. GPS of vessel + distance and bearing but animals > 1000m).
	1	Accurate within 50m (e.g. GPS + precise estimates of range and bearing).
	0	Not known.
Bearing	0 - 360	Compass bearing from observer to animal(s)
	-1	Not recorded
Distance	Numeric	Distance from observer to animal(s) in metres
	-1	Not recorded
Depth	Numeric	Depth in metres if recorded in the field.
	-1	Not recorded

Sightings Database (continued)

Field Name	Code	Variable
Animal_heading	N	N (340-22)
	NE	NE (23-67)
	E	E (68-112)
	SE	SE (113-157)
	S	S (158-202)
	SW	SW (203-247)
	W	W (248-292)
	NW	NW (292-339)
	VAR	Variableor no particular direction
	NR	Not recorded
Behaviour_1	SURF	Surfacing the only behaviour seen
	NORM	Swimming at normal speed.
	FAST	Fast swimming or porpoising.
	BLOW	Blow.
	FEED	Feeding or foraging.
	JUMP	Breaching or jumping.
	SLAP	Tail or flipper slap.
	HEAD	Spy hopping or raising head above surface.
	WAVE	Bow riding or riding any wave created by boat.
	REST	Resting or lying still on the surface.
	SEXY	Sexual behaviour.
	AGRO	Aggressive behaviour.
	NOTR	Behaviour was not recorded.
Behaviour_2	As above	As Behaviour_1
Reaction	POS	Attracted to the vessel, e.g. changed direction of movement towards the vessel or came to bow ride.
	NEG	Avoided the vessel, e.g. seen to change heading away from the vessel.
	NON	No response seen, although there was a boat in the vicinity.
	NR	Reaction was not recorded or no boats in the vicinity.
Assoc_birds	Text	See Appendix 4
Repeat_sighting	0	No – this is the first sighting of this group
	Sighting_ID	If this group has already been sighted, enter the sighting ID of the first time the group was sighted, e.g. sCW002545.
Additional _information	Text	Any relevant information not covered by above fields

Appendix 3: Species Codes

Dolphins	Codes
Atlantic spotted dolphin	ASD
Bottlenose dolphin	BND
Common dolphin	SBCD
Pantropical spotted dolphin	PSD
Risso's dolphin	RD
Rough-toothed dolphin	RTD
Striped (Euphrosyne) dolphin	SD
White-beaked dolphin	WBD
White-sided dolphin	AWSD
Fraser's dolphin	FD
Long-snouted spinner dolphin	SPD

Baleen whales	
Blue whale	BW
Bryde's whale	BRW
Fin whale	FW
Humpback whale	HW
Minke whale	MW
N. right whale	NRW
Sei whale	SW

Large Delphinids	
Beluga	BEL
False killer whale	FKW
Killer whale	KW
Long-finned pilot whale	LFPW
Narwhal	NARW
Pygmy killer whale	PKW
Short-finned pilot whale	SFPW
Melon-headed whale	MHW

Porpoises	
Harbour (common) porpoise	HP

Beaked whales	
Blainville's beaked whale	BBW
Cuvier's beaked whale	CBW
Gervais' beaked whale	GBW
N. bottlenose whale	NBW
Sowerby's beaked whale	SBW
True's beaked whale	TBW

Sperm whales	
Dwarf sperm whale	DSPW
Pygmy sperm whale	PSPW
Sperm whale	SPW

Ambiguous sightings	
Cetacean sp.	UNCE
Beaked whale sp.	UNBW
Dolphin sp.	UNDO
Large whale	UNLW
Patterned dolphin sp.	UNPD
White-beaked/white-sided	UNBS
Common/striped	UNCS
Fin/sei	UNFS
Small whale	UNSW
Mesoplodon species	MESOP

Species Codes continued

Pinnipeds	
Seal sp.	UNSE
Grey seal	GRS
Common (harbour) seal	COS
Walrus	WALR
Bearded seal	BES
Harp seal	HAS
Hooded seal	HOS
Ringed seal	RIS
Sealion	SELI

Others	
Sunfish	SUFI

Sharks	
Shark sp.	UNSH
Basking shark	BASH
Porbeagle shark	POSH
Hammerhead shark	HASH
Blue shark	BLSH

Turtles	
Turtle sp.	UNTU
Loggerhead turtle	LOTU
Leatherback turtle	LETU

Appendix 4: Associated Bird Species Codes

Associated seabirds	Seabird code
Not recorded	NOR
None present	NOP
Fulmar	FUL
Cory's shearwater	CSH
Greater shearwater	GSH
Sooty shearwater	SSH
Manx shearwater	MSH
Shearwater (unidentified)	SHW
British Storm petrel	BSP
Leach's storm petrel	LSP
Petrel	PET
Shag	SHG
Cormorant	COR
Gannet	GAN
Kittiwake	KIT
Herring gull	HEG
Lesser black-backed gull	LBB
Greater black-backed gull	GBB
Black-headed gull	BHG
Gulls (unidentified)	GUL
Arctic skua	ASK
Great skua	GSK
Pomarine skua	PSK
Long-tailed skua	LSK
Skua (unidentified)	SKU
Atlantic puffin	PUF
Common guillemot	COG
Black guillemot	BLG
Guillemot	GIL
Razorbill	RAZ
Auk (unidentified)	AUK
Arctic tern	ART
Common tern	COT
Little tern	LIT
Sandwich tern	SAT
Tern (unidentified)	TER
Grey phalarope	GPH
Red-necked phalarope	RPH
Other	Specify
Species not recorded (but seabirds present)	SEB
More than 1 species but species not identified.	VAR

Appendix 6 – Notes on Latitude and Longitude

Positions on land are usually described by a grid reference derived from the Ordnance Survey National Grid, or the equivalent in other countries. This system assumes that the earth is flat, or at least very nearly so over relatively short distances. However, mariners cannot rely on this convenient assumption, especially when travelling over greater distances, and so they use the latitude and longitude system for describing the position of locations on the surface of our (approximately) spherical planet.

Latitude and longitude are both derived from angles, therefore the units they are expressed in are degrees. If we drew an imaginary line from a given position to the centre of the earth, then the latitude of that position is the angle between that line and the plane of the equator. Thus the latitude of the North Pole is exactly 90º North, the equator lies at 0º, and a location half way between is 45º North. In other words, the latitude tells us the angular distance of a location, north or south of the equator. In exactly the same way, the longitude tells us the angular distance east or west of an imaginary line on the surface of the globe, passing through Greenwich in London and both poles – the so-called Greenwich meridian.

Note that the maximum possible value for a latitude is 90º, whereas longitude can approach 180º. Therefore only 2 digits are required for the number of latitude degrees, while longitude potentially requires 3 digits.

Traditionally, degrees are subdivided into minutes and seconds. There are 60 minutes in a degree and 60 seconds in a minute. The symbol used to indicate minutes is like a single quotation mark and a double quotation mark is used for seconds. Thus 52º 15’ 30” N means: 52 degrees 15 minutes and 30 seconds north.

With the advent of electronic navigation aids, the degrees-minutes-seconds notation has become superseded by the far more convenient decimal system. However, it is frequently the case that a hybrid system of notation is used, of degrees and decimal minutes, thus doing away with the seconds, but retaining the minutes. Using this system, the latitude of 52º 15’ 30” N referred to above becomes 52º 15.5’ N. Most boat operators in the UK have their GPS receivers set to display degrees and decimal minutes.

The problem associated with using degrees and decimal minutes is that such data cannot be manipulated as a single number in a computer spreadsheet or database. The solution is to use decimal degrees: our position of 52º 15.5’ N then becomes 52.2583º N.

In addition to being single decimal values that can be easily stored and manipulated by computer programs, the decimal degree notation has the added advantage that we can also do away with the requirement to indicate the meridian (East or West for longitude, North or South for latitude), by making all latitudes south of the equator and longitudes west of the Greenwich meridian, negative. This is best illustrated by the examples in the table below.

Location	Degrees, minutes & seconds	Degrees & decimal minutes	Latitude decimal degrees	Longitude decimal degrees
Dungeness Point	50º 54’ 45” N 0º 58’ 43” E	50º 54.75’ N, 0º 58.71’ E	50.9125	58.9785
St David’s Head	51º 54’ 7” N 5º 18’ 54” W	51º 54.12’ N, 5º 18.90’ W	51.9020	-5.3150
Cape of Good Hope	34º 21’ 43” S 18º 29’ 57” E	34º 21.71’ S, 18º 29.95’ E	-34.3618	18.4992
Cook Strait (New Zealand)	41º 12’ 47” S 174º 27’ 37” E	41º 12.78’ S, 174º 27.61’ E	-41.2130	174.4602

Incidentally, a nautical mile is defined as one minute of longitude on the equator. Therefore the circumference of the earth at the equator is 360 X 60 = 21,600 nautical miles.

Converting to decimal degrees

In the case of latitude, all our sightings are from the northern hemisphere and so are represented by a positive number with up to 4 decimal places. Longitudes may be either east or west of the Greenwich meridian, those to the east are positive and those to the west are negative decimal numbers. Thus for example, the position 52º 30min N, 5º 30min W, when converted to decimal degrees is represented by latitude = 52.5000, longitude = -5.5000. The formulae for converting from degrees and decimal minutes, and from degrees, minutes and seconds to decimal degrees are given in the table below.

Original position data	Format	Conversion formula for latitudes north of equator and longitudes east of Greenwich meridian.	Conversion formula for longitudes west of Greenwich meridian
Degrees and decimal minutes	ddº mm.mm′	= dd + (mm.mm / 60)	= -dd - (mm.mm / 60)
Degrees, minutes and seconds	ddº mm′ ss″	= dd + (mm / 60) + (ss / 3600)	= -dd - (mm / 60) - (ss / 3600)

Converting minutes and seconds to decimal minutes

To convert minutes and seconds to decimal minutes, divide the seconds by 60 and add the result to the minutes. Alternatively, use the table below to look up the decimal fraction of a minute represented by the seconds, and add that to the minutes.

Example:

52º 12′ 48″ means 52 degrees, 12 minutes and 48 seconds.
Look up 48 seconds in the table below, which shows this equals 0.80 minutes. Add this to the whole number of minutes (12) to give 12.80 decimal minutes.

Conversion table for seconds to decimal minutes.

Seconds	Decimal minutes	Seconds	Decimal minutes	Seconds	Decimal minutes	Seconds	Decimal minutes
0	0.00	15	0.25	30	0.50	45	0.75
1	0.02	16	0.27	31	0.52	46	0.77
2	0.03	17	0.28	32	0.53	47	0.78
3	0.05	18	0.30	33	0.55	48	0.80
4	0.07	19	0.32	34	0.57	49	0.82
5	0.08	20	0.33	35	0.58	50	0.83
6	0.10	21	0.35	36	0.60	51	0.85
7	0.12	22	0.37	37	0.62	52	0.87
8	0.13	23	0.38	38	0.63	53	0.88
9	0.15	24	0.40	39	0.65	54	0.90
10	0.17	25	0.42	40	0.67	55	0.92
11	0.18	26	0.43	41	0.68	56	0.93
12	0.20	27	0.45	42	0.70	57	0.95
13	0.22	28	0.47	43	0.72	58	0.97
14	0.23	29	0.48	44	0.73	59	0.98