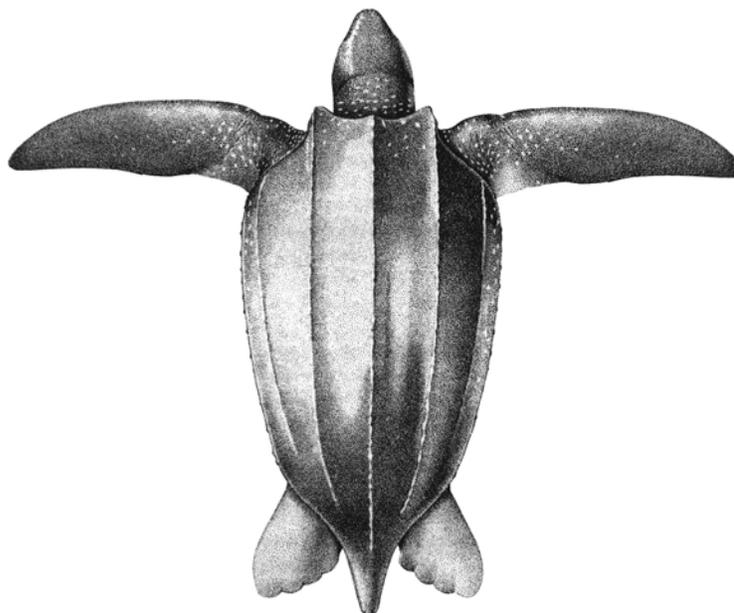


TURTLE

A Database of Marine Turtle Records for the
United Kingdom & Eire

Version 1.3 (Dec. 2002)

Introduction, Data Summary & User Notes



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INTRODUCTION

Marine turtles never fail to attract the attention of the general public and biologists alike, and records documenting their presence around our coasts have been maintained since at least the eighteenth century (Borlase, 1758). There is now therefore, a wealth of information concerning turtle strandings and sightings at sea. These records are held at locations throughout the UK and Eire, by many different institutions, organisations and individuals. Some records are kept in electronic formats; others are filed on paper. The diversity of formats and the number of locations at which data are held has however, hampered access to the information itself and consideration of the dataset as a whole. Fortunately, several reviews exist which have collated turtle records by species and by region (Brongersma, 1972; King, 1984; Penhallurick, 1990; Langton *et al*, 1996). These form the basis of the present project, the aim of which has been to establish a central database of turtle records for the UK and Eire.

The database, TURTLE, includes information published in popular accounts and the scientific literature, as well as unpublished data held elsewhere. It presents turtle records in a standard, digital format which, it is hoped, will aid analysis, stimulate new research, and also help to rationalise future data collection in the UK and Eire.

This report provides an introduction to the marine TURTLE database with field descriptions and user notes and a summary is provided of the initial data set. An overview is also provided below of organisations and individuals currently involved in the collection of data concerning stranded turtles and sightings of turtles at sea.

The TURTLE database project was financially supported by English Nature as a contribution to the Species Recovery Programme. Supervision was provided by the Joint Nature Conservation Committee.

(a) Marine turtle strandings

Several UK and Irish institutions and organisations currently collect records of stranded animals. In England and Wales, strandings have traditionally been reported to the Natural History Museum who, with the National Museum of Wales hold the national specimen collections. In Wales, Marine Environmental Monitoring and the RSPCA respond to turtle strandings, whereas in England, the Cornwall Wildlife Trust, Herpetofauna Consultants International, the RSPCA, the Environment Agency and other organisations have all attended strandings. The Institute of Zoology has now carried out full *post mortem* examinations of freshly dead leatherback and hardshell turtles.

In Scotland, the national collection is housed at the National Museum of Scotland in Edinburgh. Scottish Natural Heritage rangers generally respond to strandings and leatherbacks and other hardshell species have now been transported to the Scottish Agricultural College, Inverness, for full necropsy. Godley *et al* (1998) report on patterns of recent marine turtle mortality in British waters, with reference to tissue contaminant levels.

In Eire, the national specimen collection is held at the National Museum of Ireland, in Dublin. Strandings are generally reported to University College Cork who carry out *post mortem* examinations. Rangers of the National Parks and Wildlife Service also respond to reports of stranded animals.

Throughout Eire and the UK there are now several aquariums with experience dealing with live strandings of smaller species, particularly loggerhead turtles. The following aquariums have assisted in the treatment and rehabilitation of stranded turtles (J. Mallinson, pers. comm.):

Northern Ireland Aquarium, Portaferry
National Aquarium, Dublin
Oban Sea Life Centre
London Zoo aquarium
Department of Oceanography, Southampton University
Weymouth Sea Life Centre
National Marine Aquarium, Plymouth
Gweek Seal Sanctuary
Penzance Aquarium.
Blue Reef Aquarium, New Quay
Dingle Aquarium

(b) Sightings of turtles at sea

Sightings of turtles at sea are reported annually by fishermen, biologists, coastguards, tourists, merchant seamen and others. Traditionally, reports would eventually reach the national museums and often the Natural History Museum in London. Nowadays, records tend to be reported via locally based organisations such as the Wildlife Trusts or the countryside agencies (English Nature, Scottish Natural Heritage and the Countryside Council for Wales). The Cornwall Wildlife Trust and the Devon Wildlife Trust now collaborate to collect and report records of sea turtles and other marine life, under the Sequest South West project. In Scotland, work by Scottish Natural Heritage has significantly raised public awareness of turtles in Scotland, and SNH now co-ordinate the collection of turtle reports at their offices in Edinburgh. In Wales, reports usually reach Marine Environmental Monitoring via harbour masters, the RSPCA, HM Coastguard and a network of coastal workers. In Eire, some records are reported via the Irish Whale and Dolphin Group based at University College Cork.

The nation-wide cetacean organisation, Sea Watch also collects reports of turtles, records of which are held on their national database. Sea Watch receive reports through a network of members, many of who carry out regular sea watches from land. Sea Watch also run their own sea-borne surveys, primarily for cetaceans.

The JNCC Seabirds at Sea Team maintain a database of turtles recorded during seabird surveys. Turtle data obtained during seabird surveys in NE Atlantic waters and the North Sea is held in the European Seabird at Sea Database.

Some individual researchers have also collected substantial numbers of records, usually on a regional or single species basis. The work of Gabriel King in Eire and Roger Penhallurick in Cornwall, for example, has become well known. These researchers receive reports of turtles regularly, both from local people and from further afield through informal networks.

Sources of records held in Version 1 of the TURTLE database are described in more detail below.

SOURCE OF RECORDS

TURTLE has drawn records from many sources: contributions of individual records supplementing relatively large record sets provided by national and regional institutions and published sources. The number of records taken from various contributory sources is given in Table 1 below.

The database includes a table of references to published sources of turtle records (BIBLIOGRAPHY). This table is not complete in Version 1, although references are included for all the major sources of data. For full references to other publications cited, the reader is directed to the DATA SOURCE from short references given in the REPORTER field. The REPORTER field includes references to newspaper and magazine articles.

Table 1. Sources of data and the number of records incorporated from each into the database. (DS = citations in the Data Source field; ADS = citations in the Additional Data Source field.)

Data Source	DS	ADS	Total
Brongersma, L.D. (1972)	204	0	204
Langton, T. <i>et al.</i> (1996)	86	82	168
Penhallurick, R.D. (1990)	77	46	123
King, G.L.. (1984)	67	27	94
Marine Environmental Monitoring	46	1	47
Irish Naturalists' Journal	33	1	34
Roger Penhallurick (Royal Cornwall Museum, Truro)	29	0	29
Scottish Natural Heritage, Edinburgh	28	30	58
Penhallurick, R.D. (1991)	24	1	25
Cornwall Wildlife Trust	20	3	23
Scottish Agricultural College	19	0	19
Sea Watch	18	14	32
Irish Whale & Dolphin Group (University College Cork)	10	0	10
Sea Mammal Research Unit (1995)	8	0	8
JNCC Seabirds At Sea Team	7	0	7
Jenny Mallinson (University Of Southampton)	6	11	17
Penhallurick, R.D. (1993)	6	0	6
Ivor Rees (University College Of North Wales)	5	3	8
Kevin Flannary (Ocean World, Dingle)	5	0	5
Herpetofauna Consultants International	4	0	4
National Museum Of Wales	3	7	10
British Marine Life Study Society	2	4	6
Nederlandse Institut Onderzoek An De Zee	3	0	3
CRS Consultancy	1	0	1
Shetland Wildlife Pages	1	0	1

(a) Reviews & published collations

Most records were found in published sources, particularly in the four collated lists mentioned below. Published sources (including King's unpublished manuscript) together accounted for 662 of 941 records examined and are cited as the primary source of 71% of the 712 records in Version 1.

There have been four major and in-depth reviews of turtle records from UK and Irish waters. Many of the records in the present database were drawn from the benchmark publication on sea turtles in European waters, written by the late Professor L.D. Brongersma (1972). Highlighting the regularity with which leatherback turtles are reported from the British Isles, Gabriel King (1984) went on to provide a list of records occurring since Brongersma's review. Gabriel King continues to actively investigate turtles in Ireland. He holds a significant number of records, which may become available for incorporation into the database at a future date (G. King, pers. comm.).

Roger Penhallurick (1990) reviewed records of all turtle species from SW England. Penhallurick drew upon the work of Brongersma and King but included many new records. He also included notes on others reported from elsewhere in the British Isles. Penhallurick supplemented his original work with detailed accounts of new records and newly discovered records from earlier years (Penhallurick, 1991; 1993).

Tom Langton, C.L Beckett, Gabriel King and Martin Gaywood (1996) more recently reviewed turtle records in Scottish waters, for Scottish Natural Heritage (SNH). This publication generated much public interest for turtles in Scotland. Subsequently, a revised 'Turtle Code' was distributed widely and SNH has become a central collection point for Scottish records.

Record numbers allocated in published lists are included in the Turtles table (ALT NOS field), to help cross-reference records between the database and the literature.

(b) Other databases & record sets

The DB NOS field of the main data tables includes alternative record numbers assigned for other electronic databases. Database numbers accompany records held by the following institutions and organisations:

- (i) Natural History Museum¹
- (ii) National Museum of Ireland
- (iii) Royal Scottish Museum
- (iv) National Museum of Wales
- (v) Royal Museum of Natural History, Leiden
- (vi) Sea Watch
- (vii) Cornwall Wildlife Trust
- (viii) Scottish Agricultural College
- (ix) Marine Environmental Monitoring
- (x) JNCC Seabirds at Sea Team / European Seabirds at Sea Database

The Biological Records Office (Monk's Wood) list marine turtles amongst species included on their database. However, relatively few records are held and these are believed to have been received from other sources (H. Arnold pers. comm.).

¹ Several historical records include references to reports having been made to the Natural History Museum. Data for which the NH Museum record numbers are not yet known are tagged 'NH' to facilitate checks at a later date.

Relatively large (non-electronic) record sets have also been contributed by the following organisations and individuals, who continue to maintain important regional or project based record sets:

- (i) Scottish Natural Heritage
- (ii) Irish Whale & Dolphin Group, University College Cork
- (iii) Roger Penhallurick (Royal Cornwall Museum, Truro)
- (iv) Jenny Mallinson (Southampton University)
- (v) Colin Speedie (Seaquest SW)

(c) Individual contributions

The names of those that have found stranded turtles or reported sightings at sea are included in the database, but are too numerous to list here. The following individuals and organisations however, have communicated either sets of several records or important information regarding turtle records:

Stella Turk (Cornish Wildlife Trust)
Ferdia Marell (National Parks and Wildlife Service)
Ivor Rees (University of North Wales)
Kevin Flannary (Ocean World, Dingle)
Mr. H. Arnold (Biological Records Office, Monk's Wood)
Nick Tregenza (Chelonia)
Royal Society for the Protection of Birds
Simon Northridge (Sea Mammal Research Unit)
Tom Langton (Herpetofauna Consultants International)
Andy Thorpe (North Sea Bird Club)
Mandy McMath (Countryside Council for Wales)
Lesley Knight (Isles of Scilly Environmental Trust)
Traffic International
Nederlandse Instituut Onderzoek an de Zee
CRS Consultancy

(d) Internet sources

The following Internet sources have also proved both a useful source of information and a means of keeping up to date with new records:

Shetland Wildlife Pages²
Cornish Wildlife Trust³
British Marine Life Study Group⁴
C-Turtle mailing list and discussion group

² <http://www.zetnet.co.uk/signs/turtles/>

³ <http://www.wildlifetrust.org.uk/cornwall/>

⁴ <http://ourworld.compuserve.com/homepages/BMLSS/news99.htm>

DATABASE STRUCTURE

Format

The TURTLE database was constructed using Microsoft Access 97 and now upgraded to MS Access 2000, a popular relational database package. Data may be exported from Access in several formats, including for example, as Excel or Lotus spreadsheets, in dBase, Foxpro or Paradox database formats or to ODBC databases. The geographical co-ordinates provided with each record enable the use of database information with GIS software.

Tables

The database includes two main data tables and three lookup tables. Details of each record are held in a table called 'TURTLES'. Additional details (measurements, *post mortem* summary, museum collections) are available for some records and are held in a table called 'ANATOMY'. Data in these tables are linked by individual record numbers.

The three lookup tables (SPECIES, MONTH and GEAR TYPE) enable additional information to be included in the results of queries and reports. They hold data on species names, months and seasons, and types of fishing gear respectively. Information in the lookup tables is accessed via simple numeric or text fields in the main tables. Lookup tables allow for example, full scientific species names to be used in place of the three letter codes used in the TURTLES table. Similarly, whilst it is easier to use numeric month codes as criteria in queries, these are interchangeable with the full or abbreviated names of months or seasons when viewing the results.

Field description

A description of fields found in the two main tables are given below and includes abbreviations and formats used in the database.

(a) Table: TURTLES

RECORD NO

This is a unique 7 digit identifier in the form T0000/01 where:

T	identifies all records of the Turtle Database for the United Kingdom & Eire
0000	is the year (0000 when the year is not known or has been estimated)
/01	is an individual number for each record of the same year

DB NOS

This field lists numbers assigned by other organisations (e.g. Marine Environmental Monitoring, National Museum of Wales) by which the record is referred to in other databases. These organisations / institutions are named in the DATA SOURCE / ADDITIONAL SOURCE fields. This field helps to locate record sets or individual records held in other databases.

NB. Sea Watch codes have been given the prefix 'SW'. Records which reference the Natural History Museum but for which the museum's database number is not known, are presently flagged 'NH'.

ALT NOS

These are reference numbers used in the text of published record collections (e.g. Brongersma, 1972; Penhallurick, 1990) and help locate the record within these sources and on accompanying charts.

SPECIES CODE

A 2 or 3-letter code representing species name. This field is linked to the SPECIES LOOKUP table allowing codes to be replaced with common or scientific species names.

LBT	Leatherback
LOG	Loggerhead
KR	Kemp's ridley
HB	Hawksbill
GT	Green turtle
UNI	unidentified turtle species.

For unidentified species, further comments on possible or probable identification may be given in the NOTES field. Turtles described as 'possible green turtle' for example, can be located using the FIND facility in Access to search the NOTES field for keyword 'green'.

GROUP SIZE

This is the best estimate of the number of turtles in view, or present at the locality at the same time. In most cases 1 turtle will have been reported. There are however, some records of aggregations of 2-20 turtles observed together. Each animal within the group is given its own entry.

HARDSHELL

If species identification is not possible but the animal has a hard shell this information is recorded here.

STRANDING OR SIGHTING?

This field with the following two fields specify the various types of turtle records: animals found stranded on land, including live strandings; animals sighted at sea, again either alive or dead; and a sub-group of turtles which were either captured deliberately or accidentally caught in fishing gear.

ST	found on land
SEA	seen at sea (includes carcasses found afloat which are towed in or later strand).

ALIVE OR DEAD?

Whether the turtle was alive or dead when first found.

CAPTURE

These codes specify whether turtles were found entangled in rope or fishing gear; whether they were captured deliberately; or if they were involved in a boat collision.

- ENT found entangled in fishing gear or indicated as bycaught as a result of *post mortem* examination
- CAP deliberate capture
- E/C G. King and other authors refer to animals that were 'captured'. Most of these are likely to have been caught accidentally in fishing gear rather than taken deliberately (G. King pers. comm.), but the exact circumstances are not clear. In some cases, the distinction between incidental and deliberate capture may be made later, when further information becomes available.
- (E) turtles which were not found entangled, but on which rope marks or fragments, or net marks were found and for which entanglement was suspected
- COL boat collision

GEAR CODE

If entangled or captured, this numeric code indicates which equipment, method or in some cases, which fishery was involved. Code '90' indicates that the gear type was not specified.

This field provides links to the GEAR TYPE lookup table, which allows the original text descriptions of the equipment to be substituted for the numeric code. Generic categories such as 'rope' or 'net' are also available.

IF FOUND ALIVE...

This field gives details of the fate of turtles that were found alive:

- K killed
- D died later
- R released alive
- C still in captivity
- (C) kept alive in captivity for some time, eventual fate not known
- ESC managed to escape attempts at capture, or freed itself from entanglement unaided.

IF FOUND DEAD...

This field specifies the state of decomposition in which dead turtles were found:

- F fresh
- SD slight decomposition
- MD moderate decomposition
- AD advanced decomposition

This field refers to state of decomposition when found, not degree of damage to carcass. The ANATOMY table includes a similar field, which contains the CONDITION SCORE allocated at the time of the *post mortem* examination.

ANATOMY LINK

Records which are tagged 'Y' in this field have additional information regarding one or more of the following: measurements / weight / gender / *post mortem* examination / storage & preservation / identification tags. These data are held in the ANATOMY table.

DATE

There are three date fields in the TURTLES table: DATE, MONTH & YEAR indicating when the turtle was first found or sighted at sea. This approach means that a complete date format is available for records for which this is known, but data may also be included for records with only approximate day, month or year provided. A single field containing the full date is useful when searching for records on a specific date; however, records are commonly selected using month or year criteria and separate fields with numeric codes facilitate this.

The DATE field provides the full date whenever this is known. Data are entered in the format dd/mm/yyyy. In historic records it is important to enter the year using the full 4-digit year. The display format of this field may be adjusted to show the full date (e.g. '14 July 1994'), day only (e.g. '14'), etc.

MONTH

This field gives numeric codes for the relevant month (i.e. 1, 2...12). Additional codes are also included for approximate month data; when the record date has been approximated to either of two adjacent months the codes for the earlier and later month are combined (e.g. " Feb or March" = 23; "Nov or Oct" = 1011). Approximations to season are also included (e.g. "summer" = 2000). All approximations are tagged 'M' in the DATEPART APPROXIMATION field.

Links to the MONTH lookup table enable full month names or season names to be specified instead of number codes, if so desired.

YEAR

This is the year in numeric format (YYYY).

If an approximate date has been provided which allows the record to be placed within a decade, then a nominal date is given in the YEAR field, and DATEPART APPROXIMATION is tagged as 'Y' indicating that the year is approximate only. Therefore, when extracting records for specific years it is necessary to include the criteria 'Not "Y"' for the DATEPART APPROXIMATION field, if only records with precise year data are required.

DATEPART APPROXIMATION

This important field qualifies any approximate data provided in the preceding date fields:

D	day number approximated
M	month not known or approximated
Y	year not known or approximated.

The amount and the precision of date information provided with turtle records vary greatly. Table 2. gives some examples of how the date fields and the DATEPART APPROXIMATION field have been compiled.

Table 2. Examples of the use of date and datepart approximation (D/A) fields.

DETAILS PROVIDED	DATE	MONTH	YEAR	D/A
(1) "2/6/98"	02/06/98	6	1998	
(2) "early September 1967"		9	1967	D
(3) "summer 1992"		2000	1992	M
(4) "June or July 1989"		67	1989	M
(5) "Either June or July 1987-88"		67	1987	MY
(6) "about 1983"			1983	Y
(7) "between 1954 and 1958"			1956	Y
(8) "date not known"				Y

In the examples: (1) only, provides full and precise date information; (1-2) only, give the precise months; (1-4) only, give the precise year. DATEPART APPROXIMATION should therefore be used in conjunction with date fields, to select records for either specific or approximate month or year ranges. In some cases it may be important to select records for a specific year only, in which case the following criteria may be appropriate:

YEAR = 1993
 DATEPART APPROXIMATION <> "Y"

However, if records for the 1960's are required then the following criteria could be specified, using YEAR only:

YEAR = Between 1960 And 1969

Some additional information (e.g. "early September") may be given in the NOTES.

COUNTRY, COUNTY, LOCATION

These three fields give a text location for records. For records from well offshore, the COUNTRY field gives country for the nearest point of land, within the UK or Eire. LOCATION includes text provided with the original record. For many records this information has been used to generate appropriate co-ordinates, and in checking plotted locations using GIS.

CO-ORDINATES

This is a text field giving latitude / longitude or OS grid references provided by the data source.

LATITUDE, LONGITUDE

All records for which sufficient data has been provided have been allocated latitude and longitude co-ordinates. These are given as decimal degrees, a format most commonly used by GIS software to create point data. Degrees West of prime meridian are negative. These data were generated from text locations if no lat / long was available, with OS co-ordinates used to improve precision whenever available.

CO-ORDINANT PRECISION

This field indicates what type of location data that was provided with the original record. It also provides a semi-quantitative measure of the plotted locations' precision:

O2	OS grid, 2 figures
O4	OS grid, 4 figures
O6	OS grid, 6 figures
L4	lat / long, to nearest minute
L6	lat / long, with seconds or decimal minutes
T2	poor text description but an attempt has been made to plot the data nonetheless. Details of the approximations made are given in brackets in the LOCATION field (e.g. "[Plotted in centre mainland Orkney]", "[Plotted off island's west coast]").
T4	adequate text location details given - plotted position probably well within 10km of true location on or close to the coast, and within a radius of 10nm at sea.
T6	good text location details - plotted position probably within 2km on or close to coast; bearing and distance given for sightings at sea.
N	text location too vague (e.g. "Hebrides", "Irish Sea") or awaiting further details before plotting.

When more than one location data type were given, the most precise data type is indicated only.

NOTES

As much extra information as possible has been included in this field, if it could not be placed in other fields. The interesting anecdotal accounts given of records by some sources (e.g. Penhallurick, 1990; King, 1984) have been summarised, out of necessity to save space, hopefully without excluding any relevant details.

REPORTED BY

This is the name of the person who found or saw the turtle(s). The names of other people who reported the record are also included, as are references to newspaper articles, etc. Also included in this field are authors cited as having published information concerning the record – for full references the reader is directed to the DATA SOURCE.

DATA SOURCE, ADDITIONAL SOURCES

The DATA SOURCE is the name of the published source, organisation or individual that has provided the information about each record. When more than one source has been found the first published is cited as the DATA SOURCE, others, often providing additional information, are included as ADDITIONAL SOURCES.

DATA ENTRY

Initials of person who first entered details of each record into the database, and the date on which the entry was made.

RECORD MODIFIED

This field has been initialed & dated, each time a significant modification has been made.

CO-ORDINANTS_PLOT CHECK

This field indicates where the records have been plotted and the position verified against either the text location or co-ordinants provided by the DATA SOURCE.

DUPLICATE CHECK

Some records are reported by two or more data sources, either because these original reports were received independently of each other, or because they have collated records over a similar time period, for example.

This field indicates records that have been checked so that the data are represented by a single entry only. Sometimes extra information has been amalgamated from more than one report.

Duplicate checks have been made by sorting the data by YEAR, MONTH and DATE and then comparing LOCATION, REPORTER, data type and NOTES fields as necessary.

Some records may refer to re-sightings of the same animal. Re-sightings are however, usually difficult to detect. No clear re-sightings (records with very similar location, time / date but reported by different people) are included in the database. The inclusion of an unknown number of re-sightings may inevitably affect indices of relative abundance based on reporting rate. However, these data may provide additional useful information on turtle distribution, habitat use and movements of individuals.

(b) Table: ANATOMY

RECORD NO, DB NOS

These data are copied directly from the TURTLES table. RECORD NO provides a referential link between data in TURTLES and ANATOMY for the same record.

SEX

Sex is given if known. The sex is shown in parentheses if it has been assumed using tail length or other features. The features used are given in COMMENTS.

MEASUREMENT PRECISION

This field uses codes to indicate whether the measurement details that follow (CCL, etc) are approximate or precise. There is an entry in this field for all records with measurement or weight details.

- M measurements are given, but there are no details of how measurements were made (e.g. whether CCL was measured as a straight length or over the curvature of the carapace).
- S standard measurements were taken, and the original record specifies precisely how the measurements were made.
- APX the record indicates that these measurements are approximate only.

When a mixture of approximate and precise measurements are given, the field names of any estimated values are listed after the M or S prefix (e.g. S.COL = the value in COL is an estimate; other values are precise measurements).

SOL (STRAIGHT)

Maximum overall length of the turtle, measured between perpendiculars above or alongside turtle, or with callipers (in centimetres).

SCL (STRAIGHT)

Straight carapace length (centimetres) measured between perpendiculars above or alongside turtle, or with callipers.

SCW (STRAIGHT)

Maximum straight carapace width (centimetres).

TTL

Length of tail from plastron (centimetres).

PTL

Ventral tail length from cloaca to tip (centimetres).

DMAX

Maximum body depth (centimetres)

SFF (STRAIGHT)

Maximum distance between extended fore-flipper tips, measured between perpendiculars above or alongside turtle, or with callipers (in centimetres).

NECK (CIRC)

Neck circumference (centimetres)

FLIPPER

Fore-flipper length from wrist to tip along leading edge (centimetres). Whether the right or left fore-flipper was measured, and any additional measurements are given in COMMENTS.

COL (CURVED)

Maximum overall length, measured over the curvature of the carapace (in centimetres).

CCL (CURVED)

Carapace length measured over the curve of the carapace alongside the mid-dorsal ridge (centimetres).

CPR (CURVED)

Carapace length measured over the curve of the carapace alongside the paramedial ridge (centimetres).

CCW (CURVED)

Maximum carapace width measured over the curve of the carapace (centimetres).

CFF (DORSAL)

Maximum distance between extended fore-flipper tips, measured over the dorsal curvature of the turtle (centimetres).

WEIGHT

Weight of turtle, given in kilograms.

WEIGHING DETAILS

This field details the method used to weigh the turtle, the estimated accuracy when available and any other details.

TAIL EXT

Dorsal tail extension beyond carapace (centimetres).

SAMPLES TAKEN

A list of any samples taken from the turtle is given, with details of who carried out the sampling, how the samples were preserved and where they were stored, if available.

POST MORTEM

This field gives the name of the pathologist who carried out a *post mortem* examination of the turtle and also the date and location.

CONDITION SCORE

This is the standard body condition score, assigned at the time of the *post mortem* examination, based on the Institute of Zoology condition code for the "Collaborative UK Marine Mammal Project".

- 2a Extremely fresh as if just died.
- 2b Slight decomposition.
- 3 Moderate decomposition.
- 4 Advanced decomposition.
- 5 Mummified carcass.

CAUSE OF DEATH

This field gives summary details only, from the *post mortem* report.

STORED?

Details of where preserved specimens are housed (e.g. museum collections).

TAG ID

Identifying numbers from tags found on the turtle.

TAG DETAILS

This field provides information such as the location and date on which the turtle was originally tagged. Details of the type of tag and the position on the animal are also given.

TAG SEARCH

This field specifies how a search was made for internal tags (e.g. PIT tag scanner; Trovan scanner).

COMMENTS

Any additional information is given in the COMMENTS field. This may include extra measurements or a note that additional data is available in the *post mortem* report, for example.

(c) Table: GEAR TYPE LOOKUP

GEAR CODE and GEAR TYPE

This is a numeric code for types of equipment and fishery methods cited in turtle interactions. These codes link records in the main table TURTLES, with the equipment type given as GEAR TYPE in the lookup table. The codes used in Version 1 are given in Table 3. Similar equipment are grouped together with similar codes; specific fisheries are given as sub-divisions of more general fishery methods.

GEAR GROUP

Similar equipment have also been grouped as either 'ROPE', 'NET', 'OTHER' or 'NOT SPECIFIED'

Table 3. The GEAR TYPE LOOKUP table.

<i>GEAR CODE</i>	<i>GEAR TYPE</i>	<i>GEAR GROUP</i>
10	ROPE	ROPE
11	POT ROPE	ROPE
11.01	POT ROPE (CRAB OR LOBSTER)	ROPE
11.02	POT ROPE (WHELK)	ROPE
12	NET ROPES	ROPE
20	NET	NET
20.01	NET (MACKEREL)	NET
20.02	NET (HERRING)	NET
20.03	NET (SALMON)	NET
21	SET NET	NET
21.11	SET NET (HAKE)	NET
21.4	STAKE NET	NET
22	PURSE-SEINE / RING NET	NET
22.01	SEINE (PILCHARD)	NET
23	TRAWL	NET
23.11	TRAWL (HERRING)	NET
23.12	TRAWL (MID-WATER)	NET
23.21	TRAWL (PRAWN)	NET
23.3	TRAWL (BEAM)	NET
24	DRIFT NET	NET
24.01	DRIFT NET (HERRING)	NET
24.02	DRIFT NET (PILCHARD)	NET
24.03	DRIFT NET (TUNA)	NET
31	HOOK & LINE (RECREATIONAL)	HOOK
32.01	HOOK & LINE (COD)	HOOK
32.02	HOOK & LINE (SHARK)	HOOK
40	ANTI-SUBMARINE NET	NET
50	HARPOON	OTHER
60	ANCHOR WARP	ROPE
90	NOT SPECIFIED	NOT SPECIFIED

(d) Table: MONTH LOOKUP

The MONTH LOOKUP table is shown in Table 4. MONTH CODE is linked to the MONTH field in the TURTLES table. This lookup table provides alternative month names and enables records grouping by season.

Table 4. The MONTH LOOKUP table.

<i>MONTH CODE</i>	<i>MONTH</i>	<i>MONTH (SHORT)</i>	<i>SEASON</i>
1	JANUARY	JAN	WINTER
2	FEBRUARY	FEB	WINTER
3	MARCH	MAR	SPRING
4	APRIL	APR	SPRING
5	MAY	MAY	SPRING
6	JUNE	JUN	SUMMER
7	JULY	JUL	SUMMER
8	AUGUST	AUG	SUMMER
9	SEPTEMBER	SEP	AUTUMN
10	OCTOBER	OCT	AUTUMN
11	NOVEMBER	NOV	AUTUMN
12	DECEMBER	DEC	WINTER
13	JANUARY OR FEBRUARY	JAN / FEB	WINTER
23	FEBRUARY OR MARCH	FEB / MAR	WINTER
34	MARCH OR APRIL	MAR / APR	SPRING
45	APRIL OR MAY	APR / MAY	SPRING
56	MAY OR JUNE	MAY / JUN	SUMMER
67	JUNE OR JULY	JUN / JUL	SUMMER
78	JULY OR AUGUST	JUL / AUG	SUMMER
89	AUGUST OR SEPTEMBER	AUG / SEP	SUMMER
121	DECEMBER OR JANUARY	DEC / JAN	WINTER
910	SEPTEMBER OR OCTOBER	SEP / OCT	AUTUMN
1011	OCTOBER OR NOVEMBER	OCT / NOV	AUTUMN
1112	NOVEMBER OR DECEMBER	NOV / DEC	WINTER
2000	SUMMER	SUMMER	SUMMER
3000	WINTER	WINTER	WINTER
4000	SPRING	SPRING	SPRING
5000	AUTUMN	AUTUMN	AUTUMN

(e) Table: SPECIES LOOKUP

The SPECIES LOOKUP table is shown in Table 4. SPECIES CODE links this table to the SPECIES CODE field in the TURTLES table. The lookup table provides alternative species names.

Table 5. The SPECIES LOOKUP table.

<i>SPECIES CODE</i>	<i>SPECIES</i>	<i>SPECIES (SCIENTIFIC)</i>
GT	GREEN TURTLE	<i>Chelonia mydas</i> (Linnaeus, 1758)
HB	HAWKSBILL	<i>Eretmochelys imbricata</i> (Linnaeus, 1766)
KR	KEMP'S RIDLEY	<i>Lepidochelys kempii</i> (Garman, 1885)
LBT	LEATHERBACK	<i>Dermodochelys coriacea</i> (Linnaeus, 1786)
LOG	LOGGERHEAD	<i>Caretta caretta</i> (Linnaeus, 1758)
UNI	UNIDENTIFIED	Unidentified

DATA SUMMARY

(a) Overview

Version 1 of TURTLE contains 712 records of 5 turtle species. By far the most commonly reported species is the Leatherback. Loggerheads are the second most frequently recorded species. Records of Kemp's ridley turtles are infrequent, and records of Green turtles and Hawksbills are exceedingly rare. The number of records of each species is shown in Table 6 below.

Table 6. The number of records of turtles identified to species.

<i>SPECIES</i>		<i>RECORDS</i>
Leatherback turtle	<i>Dermodochelys coriacea</i> (Linnaeus, 1786)	461
Loggerhead turtle	<i>Caretta caretta</i> (Linnaeus, 1758)	94
Kemp's ridley turtle	<i>Lepidochelys kempii</i> (Garman, 1885)	25
Green turtle	<i>Chelonia mydas</i> (Linnaeus, 1758)	4
Hawksbill turtle	<i>Eretmochelys imbricata</i> (Linnaeus, 1766)	1

The remaining 127 records are of unidentified species.

There are 458⁵ records of sighting at sea, and 217 strandings. It is unclear whether the remaining 38 records refer to turtles seen at sea or which stranded.

Approximately 23% of records were subject to incidental capture by entanglement (usually in fishing equipment) or deliberate capture. A minimum of 104 animals were found entangled in fishing equipment. One further turtle became entangled in an anti-submarine net, another in the anchor warp of a small boat, and there is one record of a

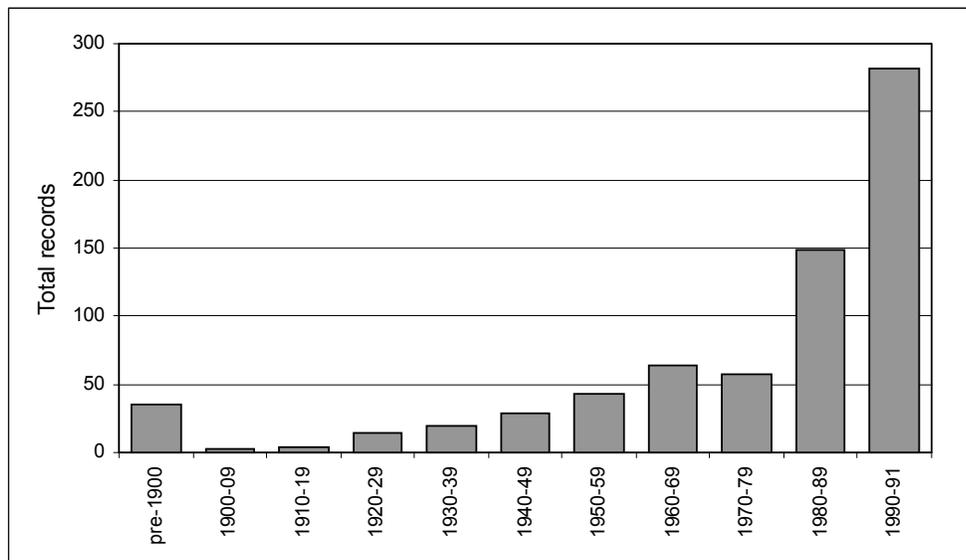
⁵ Some animals found at sea later stranded, were landed or were towed to shore, and were then dealt with as strandings.

turtle being harpooned. An additional 51 turtles were either accidentally entangled or captured deliberately, but the exact circumstances are unclear in the original report.

Of the 104 known to have been entangled, 51 (49%) were caught in ropes, particularly those used as buoy ropes on shellfish pots; 37 (36%) were trapped in fishing nets, including set nets, trawls, drift nets and purse-seines; 4 (4%) were caught on hook and line. Entanglement does not necessarily result in drowning, as a significant number of turtles are released 'unharmd'. Records concerning turtle bycatch are dealt with in more detail elsewhere (Pierpoint, in prep.).

The database shows that the total number of records reported each year increased steadily throughout the 1900s. However, the reporting rate has increased exponentially since the early 1980s (Fig.1). Reasons for this recent increase no doubt include increased public awareness and interest in marine wildlife, and the development of reporting networks. The consistently high numbers of marine turtles now reported annually do suggest however, that there may have been an increase in the number of animals visiting UK and Irish waters. Turtles have now been reported annually since 1952.

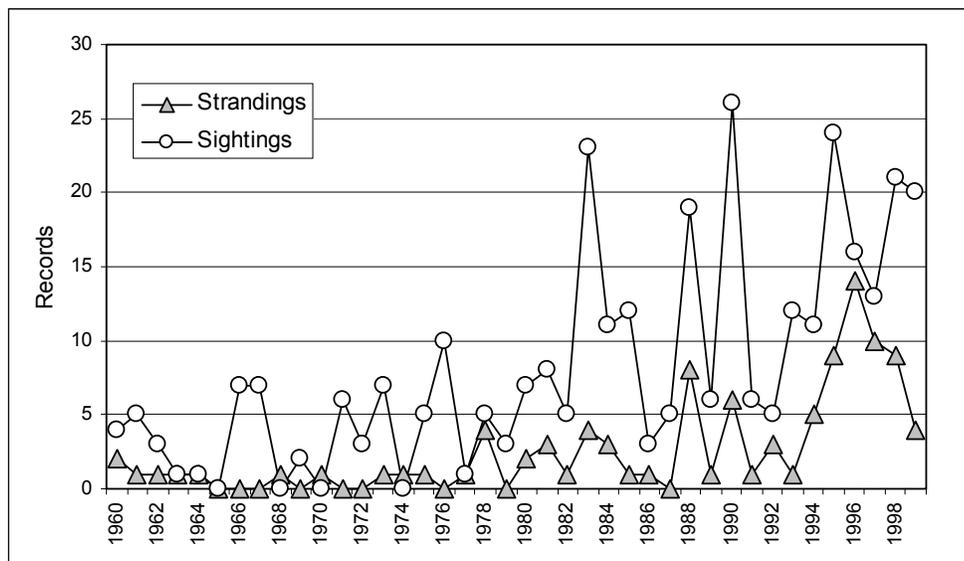
Fig. 1. Total records by decade.



Years with relatively high numbers of turtles reported tend to be sporadic and vary between species. Years in which relatively high numbers of loggerhead turtles for example, stranded on the UK and Irish coasts are: 1938 (5 records), 1945 (5 records), 1990 (17 records) and 1992 (5 records). The 1990 'invasion' was clearly exceptional.

For leatherbacks there is not always a good correlation between the number of sightings at sea and the number of strandings reported. However, in recent years with relatively high numbers of strandings (1988, 1990, 1995, 1996, 1997 & 1998) there have been correspondingly high numbers of sightings reported also (Fig.2).

Fig. 2. Records of leatherback turtle sightings and strandings, since 1960.



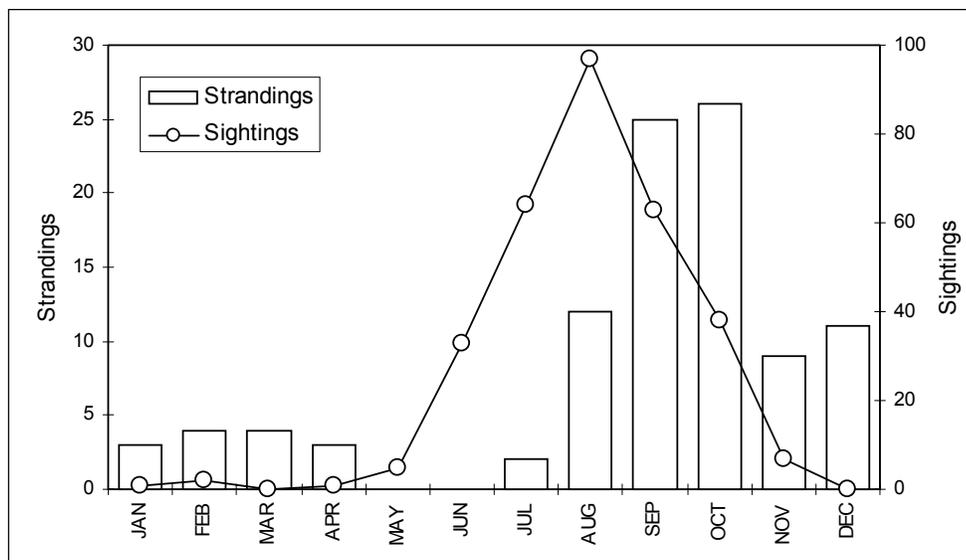
(b) Species accounts

(i) Leatherback turtle

Leatherbacks are the most commonly reported turtle species in UK & Irish waters (n = 461 records) and the species is now widely regarded as a regular member of the British and Irish marine fauna (Godley *et al*, 1998). Leatherbacks have been reported in every month. However, most sightings are made in the summer between July and October, with a peak in August (Fig. 3). Overall, strandings peak later, in September and October. There appears however, to be some regional variation in the months in which most reports occur: the first reports each year of live leatherbacks usually come from southern Eire and SW England, whereas the relatively few leatherbacks reported from North Sea coasts appear later in the year, mostly during the winter and early spring. In the NW Atlantic correlation has been found between the occurrence of leatherback turtles and that of their jellyfish prey (Grant *et al*, 1996); there are many anecdotal reports suggesting that this may also be the case in British waters.

The distribution of all leatherback records with sufficiently precise location data, is shown in Fig.6. Although there are records from all around the UK & Irish coasts, records are concentrated on the west and south coasts of Eire, southwest England, south and northwest Wales, the west coast of Scotland, Orkney and Shetland.

Fig. 3. Leatherback sightings and strandings by month.
NB. These data have been pooled for all regions; strandings include turtles found in states of advanced decomposition as well as fresh carcasses.

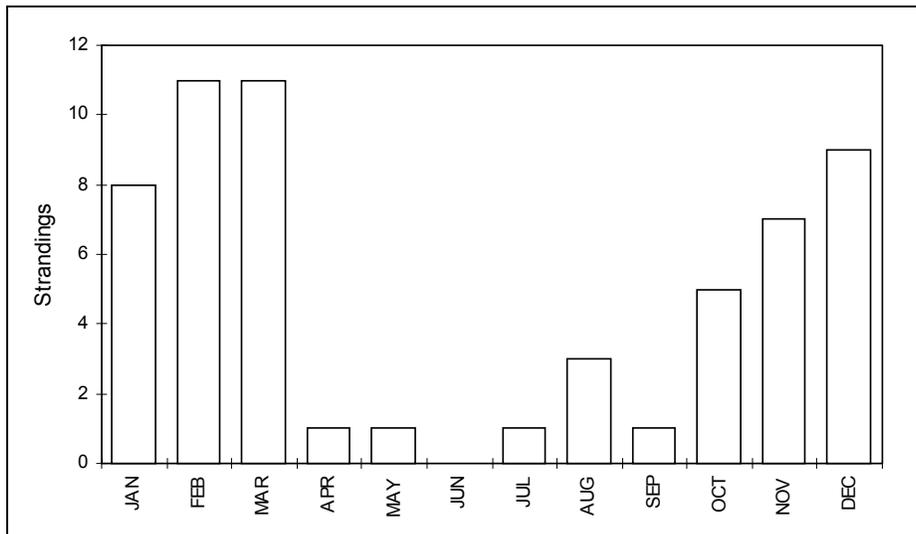


(ii) Loggerhead

The database holds 94 records of loggerhead turtles. Loggerheads are most frequently reported as strandings (81%), although the database does hold several reports of sightings at sea. Most animals strand alive ($n = 41$; 69%) and several have now been released in warmer waters after having received specialist, rehabilitative care (J. Mallinson, pers. comm.). Strandings occur most frequently during winter and spring, when animals are observed to have become lethargic in cold waters. Multiple strandings have occurred after storms. Godley *et al* (1998) suggest that the presence of loggerhead turtles in UK & Irish waters is most often the result of animals having been carried by currents from their normal habitat. This may be equally true of Kemp's ridley and other normally warm water species.

The distribution of all loggerhead records is shown in Fig. 7. Most loggerheads have been found on the west coast of Eire, southwest England and the west coast of Scotland.

Fig. 4. Loggerhead strandings by month.

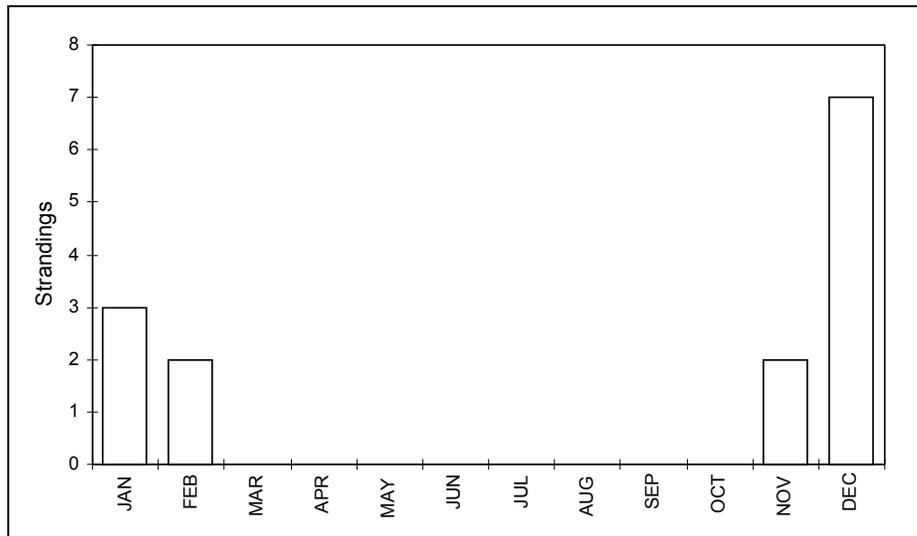


(iii) Kemp's ridley

The database holds 25 records of Kemp's ridley turtles, the most recent from the Isles of Scilly in October or November 1998 and in February, 1999. Records are almost exclusively stranding reports, although at least 2 turtles became trapped in fishing gear. In 17 records for which it is known whether stranded animals were found alive or dead, 53% were alive; none of these survived long ashore. Strandings have been reported from November to February (Fig. 4). Two animals were also found at sea in November.

The distribution of Kemp's ridley turtles (Fig. 8) is similar to that of loggerheads: most records of the species are from southwest England, including the Scilly Isles.

Fig. 5. Strandings of Kemp's ridley turtles.
NB. An additional 2 turtles stranded in either October or November.



(iv) Green turtle

There are 4 records of green turtles in the database. Two records from the south coast of England (Fig. 8), during the 1800s, are reported by Brongersma (1972). Brongersma comments that these animals may be amongst those that reached European waters by ship, imported as food.

There are two recent records: one was found dead on the shore of the Loch of Stenness, Orkney in 1980 (Grey, 1981 cited in Booth & Booth, 1994); a second was sighted in the North Sea in July 1999, during a seabird survey (Kees Camphuysen pers. comm.) (Fig. 8).

(v) Hawksbill

There is a single record of a hawksbill turtle. This turtle became trapped in herring nets off Cork Harbour in February, 1983 (O'Riordan *et al*, 1983) (Fig. 8).

Fig. 6. Distribution of leatherback turtle records

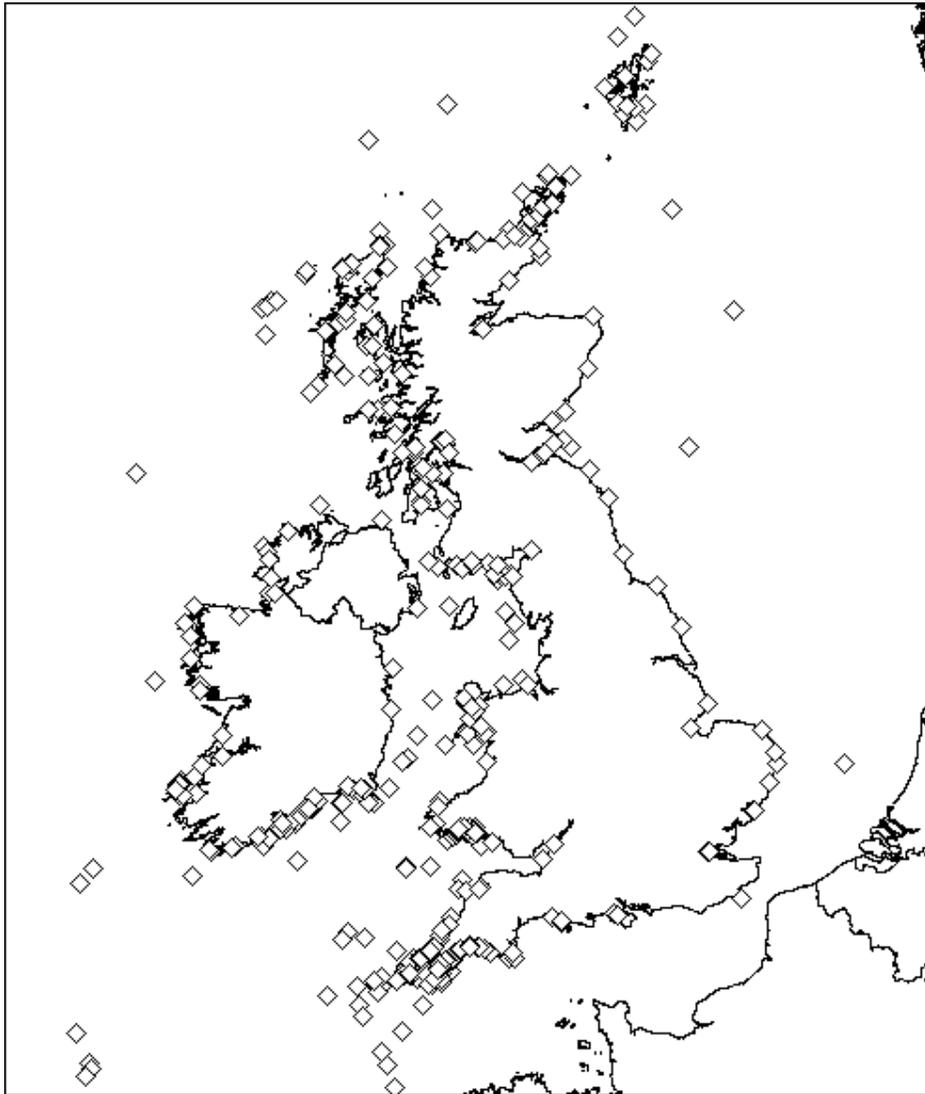


Fig. 7. Distribution of loggerhead turtle records

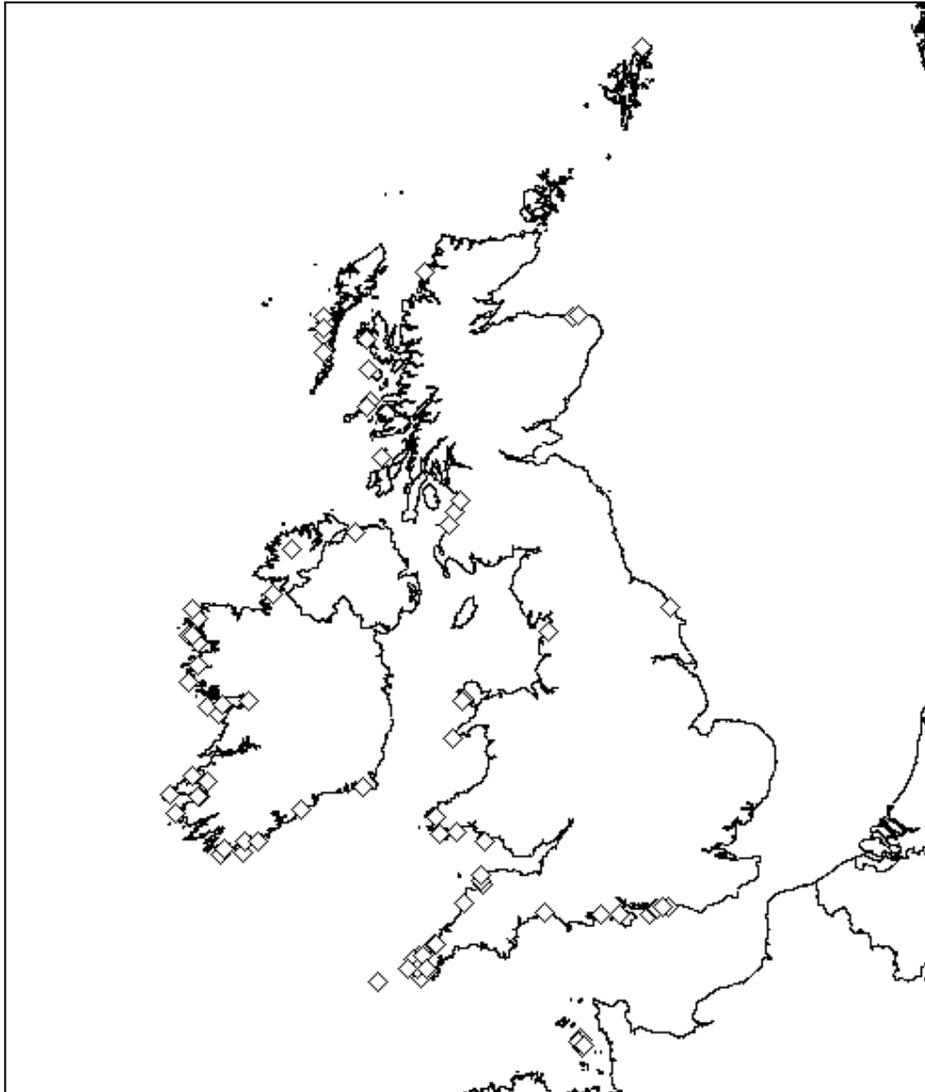
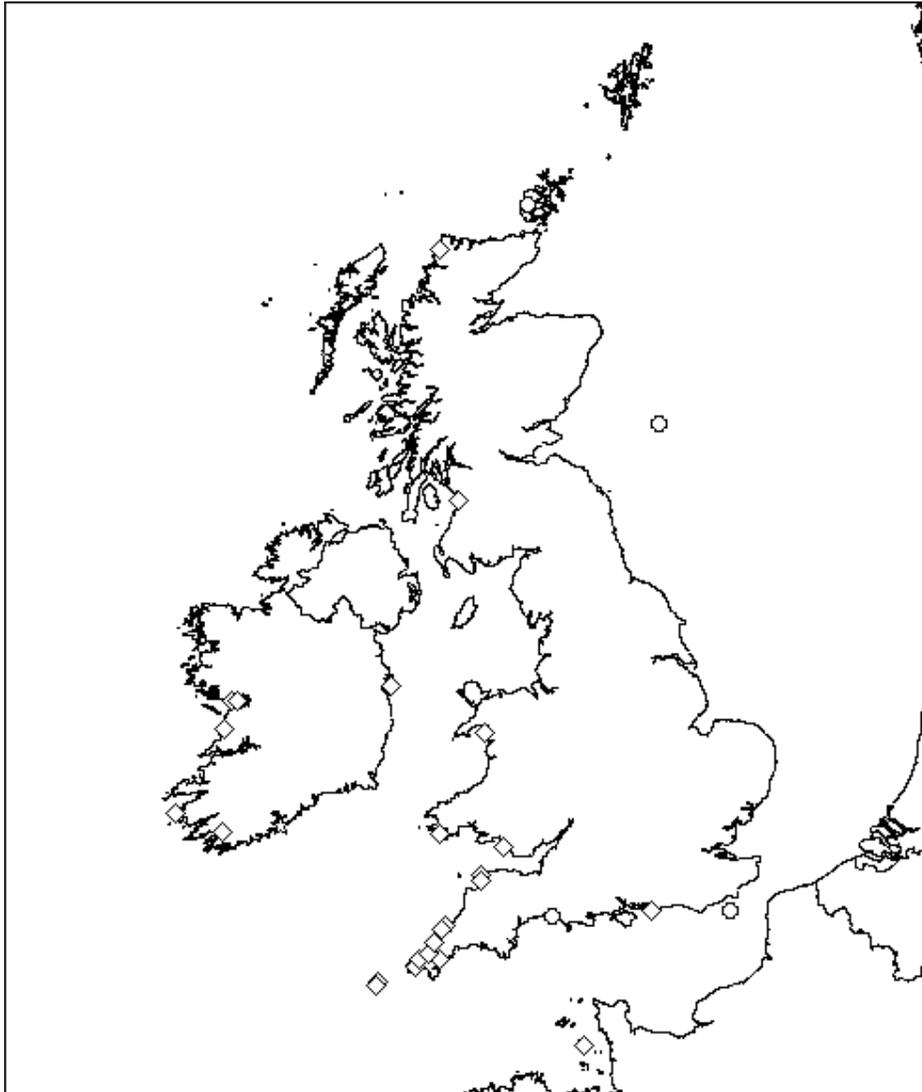


Fig. 8. Distribution of records of Kemp's ridley (◇), hawksbill (☆) & green turtles (○).



SUMMARY

TURTLE is a central database of marine turtle records for the United Kingdom & Eire. Its contents have been drawn from several published sources, including four important reviews of turtle records (Brongersma, 1972; King, 1984; Penhallurick, 1990; Langton *et al*, 1996), as well as from record sets held by organisations, museums and individual workers throughout the region. The database includes information on stranded animals, details of sightings at sea and of bycaught animals. Version 1 of the database holds 712 records. All five North Atlantic species are represented, but most records (at least 65%) are of leatherback turtles.

The database was assembled in MS Access 97 now upgraded to MS Access 2000, a popular relational database package that allows data to be exported in a wide range of other formats. Data on species, data type, date, location, data sources, etc. are held in a single main table (TURTLES). Additional data for many records is placed in a second, linked table (ANATOMY). This table includes measurement data and information on *post mortem* examination, storage of specimens and tagging, etc. Three lookup tables give access to further information on fishing gear interaction, months and seasons and species names. A bibliography table provides references to published record sources cited in the database. In order to take full advantage of relationships and links between tables in the database, it is recommended that TURTLE is run in Access 2000 or similar software.

All records have been assigned an individual identifying number, but alternative record numbers used by other databases and in the text of published sources, have also been incorporated to aid cross-referencing. The majority of records have been assigned latitude and longitude co-ordinates in a format used by most Geographical Information System (GIS) software.

This report gives an introduction to the TURTLE database project and provides user notes and field descriptions. A brief summary of the data in Version 1 is also included which describes seasonal and annual variation in reporting, and the geographical distribution of records of each species. The data show that the reporting rate for turtles has increased exponentially since the 1980s. This is likely to be due, at least in part, to increased public interest of marine wildlife in general, and to the development of reporting networks. For some species however, this trend may also reflect an increase in the number of turtles visiting UK and Irish waters.

Several 'invasion years' are apparent for loggerhead and leatherback turtles, during which unusually high numbers of animals were recorded. Loggerheads are thought to arrive on our shores after having been carried from their normal habitat by adverse currents whereas leatherback turtles are now widely accepted as a regular member of the British and Irish marine fauna (Godley *et al*, 1998). There have been several years with relatively high numbers of leatherback sightings and strandings reported since 1988; this is perhaps correlated with years in which their jellyfish prey have also been abundant (Grant *et al*, 1996).

Most leatherbacks are reported from the west and southwest coasts of Britain and Eire, mainly in summer and autumn. Animals reported from North Sea coasts however, occur more often in the winter and spring. This may reflect patterns of movement from the west to the east coast of Britain through Scottish waters and perhaps the English Channel. The smaller loggerhead and Kemp's ridley turtles are mostly reported as

strandings usually during the winter and spring. Loggerheads are often found alive and several juvenile animals have now been released in warmer waters after having received specialist rehabilitative care, most notably at the National Aquarium of Ireland at Portferry (J. Mallinson, pers. comm.).

TURTLE also holds data on bycaught animals, including information on the type of fishing gear and the particular fishery involved. Fisheries bycatch has proved to be a major source of turtle records. Over 28% of leatherbacks were found entangled or in a few cases, had been captured deliberately. The first application of the database will report in more detail on turtle bycatch (Pierpoint C, 2000. Bycatch of marine turtles in UK waters. JNCC Report No.310).

It is recommended that the TURTLE database is updated annually. To facilitate this, it would be useful to build upon the informal network of institutions, organisations and individuals that have each contributed data to Version 1. Ideally, new records should be collated by those to which the database is distributed, using a similar format and fields. Reports could then be forwarded, on a regular basis, to the database manager. It would be the responsibility of the database manager to check for duplicate data, enter new records and assign record numbers, and to distribute an updated version of TURTLE at the beginning of each year.

The future utility of the database will rely on the exchange of information with other databases and with the many established regional record keepers. An annual data report could therefore provide useful feedback, giving an overview of reports from the UK and Eire.

Some aspects of the recording process may be improved. Specifically, there is a need to rationalise and standardise the methods by which measurements are taken from stranded and bycaught turtles. It was necessary to add several fields to the ANATOMY table to accommodate the different measurements that have been taken in the past and by different individuals. A further field has been included to specify whether measurements were taken in a specified manner, or if the measurement method is not known. Much useful data can be collected from turtles, on the quite rare occasions that this is possible around our coasts. However, comparability would be improved and the overall dataset benefit greatly from the adoption of standard methods of recording.

There are also many records in the database for which some important data are missing. It is often unclear whether a turtle was found stranded or sighted close to shore for example. Sometimes the report omits to mention whether the animal was found dead or alive, and if found alive, in fishing gear for example, whether it was later released. It would be useful therefore, if data at the many record centres around the UK and Eire were held in a standard format (written forms or spreadsheets) and if measures were taken to follow up reports to ensure that all the basic data are known.

It is hoped that this database will provide access to a large body of information on turtle sightings and strandings which up until now, has been housed in a variety of diverse formats and locations. These data may provide insights to the ecology and movements of turtle species in UK and Irish waters. They may also help us to assess the impact of threats facing these vulnerable members of our marine fauna and take steps to ensure their conservation.

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