# Stranded beaked whales in France: 1970-2010

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#### ABSTRACT

This paper is a compilation of 130 beaked whale stranding events recorded by the French stranding scheme over the period 1970\_2010. Totals of 101 Ziphius cavirostris, 9 Hyperoodon ampullatus, 15 Mesoplodon bidens, 4 M. densirostris and 1 M. europaeus were found. The southern part of the Bay of Biscay is the main stranding area for Ziphius in France, both in terms of numbers and diversity, possibly as a result of the relative proximity of the shelf break to the coast. No long term trend was shown, but a seasonal pattern of occurrence was found for Ziphius in the bay of Biscay, with a higher frequency in winter, as well as two period of unusual stranding frequency in the years 1979-1982, and 2007-2008. A closer examination of the stranding time series suggests that several events that were initially thought to be unrelated could be reconsidered as being unusually close to one another both in time and space and would deserve more attention in the context unusual mortality event (UME) associated to sound exposition.

# **INTRODUCTION**

Despite recent research efforts, beaked whale are still suffering lack of basic data for their appropriate conservation. Many factors, such as their low densities, long and deep dives, inconspicuous surface behavior, preferential habitats in slope and oceanic waters, make conducting dedicated studies on these animals one of the most difficult challenge in cetacean research. Basic information on numbers, distribution, biology and interaction with human activities are still fragmentary. In this context, even if the scientific exploitation of stranded cetaceans is better fitted to monitoring coastal species than oceanic ones, the analysis of long stranding data time series reveal species composition and spatio-temporal patterns that can be compared to the limited data available to date. Here we compile stranding data of beaked whale along the coast of France (excluding over-seas territories) during the period 1970-2010 in the aim to determine spatio-temporal patterns and, in particular, investigate if unusual mortality events could be suspected.

# MATERIAL AND METHODS

The French stranding scheme was established by Dr. Raymond Duguy in the late 1960s early 1970s (e.g. Duguy 1990). One considers that by 1980 its current organization was in place. The general objectives of the network changed with time. Initially designed as a tool to determine general faunistic composition for marine mammals in French waters (in the 1970s), the network then provided scientific material for natural history museums (mostly osteological collections) and studies in comparative anatomy, biology and ecology of marine mammals (1980s to early 1990s) and finally became a tool for monitoring the condition of marine mammal populations from 2000 onward. As a result, protocols for examining carcasses of stranded marine mammals changed over time. In this compilation, we used only baseline information constituted of species, date and location of the stranding events that have been collected since the beginning.

## RESULTS

#### General

From 1970-2010, a total of 130 beaked whales belonging to 5 different species have been reported stranded along the North Sea and English Channel, the Atlantic (Bay of Biscay) and the Mediterranean coasts of France, over-seas territories being excluded, (Table 1); this represents *c*. 1% of all cetacean stranding events reported over the period. The Cuvier's beaked whale *Ziphius cavirostris* accounts for about three quarters of these records (101 individuals), whereas northern bottlenose whale *Hyperoodon ampullatus* (9 individuals), Sowerby's beaked whale *Mesoplodon bidens* (15 ind.), Blainville's beaked whale *M. densirostris* (4 ind.) and Gervais' beaked whale *M. europaeus* (1 ind.) constituted the rest of the records. Usual numbers of beaked whale stranding events are 0-2 along the Channel and Mediterranean coasts and 0-4 in the Bay of Biscay (Figure 1).

| Species                   | North   | Sea | Bay of Biscay | Mediterranean | TOTAL |
|---------------------------|---------|-----|---------------|---------------|-------|
|                           | Channel |     |               |               |       |
| Northern bottlenose whale | 5       |     | 4             |               | 9     |
| Cuvier's beaked whale     | 1       |     | 77            | 23            | 101   |
| Sowerby's beaked whale    | 8       |     | 7             |               | 15    |
| Blainville's beaked whale |         |     | 4             |               | 4     |
| Gervais' beaked whale     |         |     | 1             |               | 1     |
| TOTAL                     | 14      |     | 93            | 23            | 130   |

Table 1: Records of stranded beaked whales in France by broad maritime regions, 1970-2010.





With one exception, the Cuvier's beaked whale was only found along the Atlantic and Mediterranean coasts while the northern bottlenose and the Sowerby's beaked whales were found in equal share along the Channel and Atlantic coasts (Figure 2a,b). Overall, the southern part of the Atlantic coast corresponds to the highest occurrence of beaked whale stranding events.

#### Long term and seasonal patterns

There is no obvious long term trend in the number of stranded beaked whales reported by the French stranding network over the period 1970-2010, irrespective of the species or maritime regions (Figure 3). Nonetheless, the number of stranded beaked whales, mostly Cuvier's, peaked at 6 to 12 individuals per year, well above usual figures of 0-4, in the Bay of Biscay during two distinct periods, 1979-1982 and 2007-2008.

In terms of seasons, only the Cuvier's beaked whale show a clear pattern in the Bay of Biscay, with maximum figures from December to March, and minima from July to October. Low numbers of stranding events for the other species/maritime regions did not allow any seasonnal pattern to be revealed (Figure 4).

### Unusual events

Single stranding events are the norm within the whole data set, as a majority of these stranding events involved only one individual at a time (Appendix 1). However, in several instances stranded beaked whale occurred by pairs or even larger numbers over a restricted period and coastal range. As many as 8 pairs of individuals were found at intervals of less than 15 days and 80 kilometers apart (Figure 5; appendix 2); similarly 4 trios of beaked whales were found within intervals of less than a month and at distance shorter than 80 km apart; finally, 2 events, which involved 4 and 8 individuals, occurred within periods of no longer than 6 and 40 days and were spread over 7 and 100 kilometers of coastline respectively. These putatively unusual stranding events occurred troughout the study period, as early as 1971 (Appendix 2).



Figure 2: Stranding locations of beaked whales in France, over the period 1970-2010. Black circles and white stars are Cuvier's beaked whales and northern bottlenose whales respectively (Figure 2a); black, grey and white diamonds are Sowerby's, Gervais' and Blainville's beaked whales respectively (Figure 2b).



Cuvier's beaked whale

Figure 3: year-to-year variations in the numbers of stranded beaked whales by broad maritime regions (French Stranding Network, 1070-2010). Only years with at least 1 stranding event recorded in any one of the maritime regions are shown; no stranding event of beaked whales was recorded in 1973 as well as over the period 1990-1993.





□ Cuvier's beaked whale □ Sowerby's beaked whale □ Northern bottlenose whale

Figure 4: seasonnal variations in the numbers of stranded beaked whales by broad maritime regions (French Stranding Network, 1070-2010).



Figure 5: duration (in days) and spatial span (in km) of multiple stranding series of beaked whales (open diamonds represent series of 2 beaked whales, black triangles of 3 beaked whales, and black diamonds of 4 beaked whales and over).

## **DISCUSSION and CONCLUSION**

With a total of 130 records, beaked whales reported stranded along the French coasts of the North Sea, English Channel, Bay of Biscay and NW Mediterranean represent about 1% of all cetaceans stranding in these areas. The Cuvier's beaked whale alone accounts for three quarter (101 events) of all beaked whale stranding events. The south of the Bay of Biscay appears to be a hot spot of frequency and diversity of beaked whales. This may be due to the proximity of the continental slope to the coast and it is also in line with data obtained at sea during recent sighting survey CODA that highlighted this area for its density of beaked whales (Hammond et al., 2009). The absence of any long term trends in stranding frequency in Ziphius along the Atlantic sea board may reflect a relatively stable population. Its offshore slope and oceanic habitats and deep-sea squid food resources (Spitz et al., 2011) may be exposed to less interactions with human activities than NW European shelf habitats. The absence of trend in the other species/maritime regions should be interpreted as merely a lack of sufficient data. Nonetheless, two episodes of higher stranding frequency were revealed, one in 1979-1982 and the other one in 2007-2008. The latter is consistent in its timing and intensity with a similar event described around the UK and Ireland (Dolman et al., 2008) during which as many as 14 Z. cavirostris and 5 M. bidens were reported stranded along the Atlantic side of the British Isles. In both cases, the bad condition of most carcasses prevented any detailed examination, and the likely causes of the unusual mortality event remained unknown. A closer examination of the timing and spatial spread of beaked whale stranding events suggest that in several instances events occurred in short series of 2 to 8 animals reported from fairly restricted stretches of coastline, suggesting a common cause of mortality. Unfortunately most pathological information is lacking, partly because of the often degraded condition of the carcasses. Nonetheless it would be interesting to examine if some of these series should be classified as unusual mortality events, in particular in the context of possible relationship with naval exercises in the area (Brownell et al. 2004).

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# **APPENDIX 1**

|      | Bay o | f Bisca | y    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |       |
|------|-------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
|      | 1971  | 1972    | 1974 | 1976 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1986 | 1989 | 1994 | 1995 | 1996 | 1998 | 1999 | 2000 | 2001 | 2002 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Total |
| Jan  | 3     |         | 1    |      |      | 1    | 1    |      | 1    | 1    |      |      |      |      |      | 1    | 2    |      | 1    |      | 1    | 1    |      | 1    | 2    |      | 17    |
| Feb  |       |         | 1    |      |      |      |      |      |      |      |      | 1    | 1    | 1    | 1    |      | 1    | 1    |      |      |      |      | 1    | 1    |      |      | 9     |
| Mar  |       | 2       | 1    |      | 6    | 2    |      |      |      |      |      |      | 1    | 1    |      | 1    |      |      |      |      |      | 1    |      | 3    | 2    |      | 20    |
| Apr  |       | 2       |      |      | 1    | 1    |      |      |      |      | 1    | 1    | 1    |      |      |      |      |      | 1    |      |      |      |      |      | 3    |      | 11    |
| May  |       |         |      |      |      | 1    |      |      |      |      |      |      |      |      |      |      | 1    |      |      | 1    | 1    |      |      | 1    | 1    |      | 6     |
| Jun  |       |         |      |      |      | 1    |      |      |      |      |      | 1    |      |      |      |      |      |      |      | 1    |      |      |      |      | 1    |      | 4     |
| Jul  |       |         |      |      |      |      |      | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    | 2     |
| Aug  |       |         |      |      |      |      |      |      |      |      | 1    |      |      |      |      |      |      |      | 1    |      |      |      |      |      |      |      | 2     |
| Sept |       |         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    |      | 2     |
| Oct  |       |         |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |      | 1    |      |      |      |      |      |      |      |      | 2     |
| Nov  |       |         |      |      |      |      |      | 1    |      |      |      |      | 1    |      |      | 1    |      | 1    |      | 1    | 1    |      |      |      |      | 1    | 7     |
| Dec  |       |         |      | 1    | 1    |      |      | 6    |      | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    | 1    |      | 11    |

# Number of beaked whale stranding event per year and month, all species combined

|      |      |        |      | Medi | terran | iean s | ea   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |       |
|------|------|--------|------|------|--------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
|      | 1971 | . 1972 | 1973 | 1974 | 1975   | 1976   | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1996 | 1997 | 2003 | 2006 | 2008 | 2009 | 2010 | Total |
| Jan  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |      |      |      |      |      | 1     |
| Feb  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |       |
| Mar  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    | 2     |
| Apr  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    |      |      |      |      | 2     |
| May  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      | 1    |      |      |      |      |      | 1    |      | 2     |
| Jun  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |      |      |      | 1     |
| Jul  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |       |
| Aug  |      |        |      |      |        |        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |       |
| Sept |      |        |      |      |        |        |      |      | 1    |      |      |      |      |      | 1    |      |      |      |      |      |      |      |      |      |      | 2     |
| Oct  |      |        |      |      |        |        | 1    |      |      |      |      |      |      | 1    |      |      |      |      |      |      |      |      | 2    |      |      | 4     |
| Nov  |      |        |      |      | 1      |        |      |      |      |      |      |      | 1    | 2    |      |      |      |      |      |      |      |      |      |      |      | 4     |
| Dec  |      |        |      | 4    |        |        |      |      |      |      |      |      |      |      |      |      |      |      | 1    |      |      |      |      |      |      | 5     |

English chanel

|      | 1971 | 1975 | 1978 | 1980 | 1987 | 1988 | 1994 | 2001 | 2008 | 2009 | Total |
|------|------|------|------|------|------|------|------|------|------|------|-------|
| Jan  |      |      | 1    |      |      |      |      |      | 2    |      | 3     |
| Feb  |      |      |      |      |      |      | 1    |      |      |      | 1     |
| Mar  |      |      |      | 1    |      |      |      |      |      |      | 1     |
| Apr  |      |      |      |      |      |      |      |      |      |      |       |
| May  |      |      |      |      |      |      |      |      |      |      |       |
| Jun  |      |      |      |      |      |      |      |      |      |      |       |
| Jul  |      |      |      |      |      |      |      |      |      |      |       |
| Aug  | 1    |      |      |      | 2    |      |      |      |      | 1    | 4     |
| Sept |      | 2    |      | 1    |      |      |      | 1    |      |      | 4     |
| Oct  |      |      |      |      |      |      |      |      |      |      |       |
| Nov  |      |      |      |      |      |      |      |      |      |      |       |
| Dec  |      |      |      |      |      | 1    |      |      |      |      | 1     |

# **APPENDIX 2**

| E      | V      | Dete       | <b>A</b> | T  | Caracian     | Numbers of  | Temporal span | Spatial span |
|--------|--------|------------|----------|--|--------------|-------------|---------------|--------------|
| Events | r ears |            | Areas    |  | Species      | individuals | (in days)     | (1n km)      |
|        | 1971   | 24-jan-/1  | A        | LA ROCHELLE                              | Cuvier's     | - 2         | 1             | 80           |
|        | 1971   | 24-jan-71  | A        | LE BOIS-PLAGE-EN-RE<br>BRETIGNOLLES-SUR- | Cuvier's     | - 3         | 1             | 80           |
| А      | 1971   | 24-jan-71  | А        | MER                                      | Cuvier's     |             |               |              |
|        | 1972   | 15-mar-72  | А        | MOELAN-SUR-MER                           | Cuvier's     | 2           | 1             | 53           |
| В      | 1972   | 15-mar-72  | А        | PENMARCH                                 | Cuvier's     |             |               |              |
|        | 1972   | 21-apr-72  | А        | BIARRITZ                                 | Sowerby's    | 2           | 5             | 260          |
| С      | 1972   | 26-apr-72  | А        | SAINT-TROJAN-LES-<br>BAINS               | Cuvier's     | 2           | 5             | 200          |
|        | 1979   | 11-mar-79  | А        | LEGE-CAP-FERRET                          | Cuvier's     |             |               |              |
|        | 1070   | 11         |          | SAINT-PIERRE-                            | Creationla   | 1           |               |              |
|        | 1979   | 11-mar-79  | A        | DOLEKON                                  | Cuvier's     | -           |               |              |
|        | 1979   | 15-mar-79  | A        |  |              | 7           | 21            | 322          |
|        | 1979   | 27-mar-79  | A        | PENMARCH                                 | Cuvier's     | -           |               |              |
|        | 1979   | 30-mar-79  | A        | ARCACHON                                 | Cuvier's     | -           |               |              |
|        | 1979   | 30-mar-79  | A        | LA TESTE                                 | Cuvier's     | -           |               |              |
| D      | 1979   | 02-apr-79  | Α        | LEGE-CAP-FERRET                          | Cuvier's     |             |               |              |
|        | 1980   | 10-mar-80  | А        | BANC-D'ARGUIN                            | Cuvier's     | -           |               | 1.50         |
|        | 1980   | 28-mar-80  | А        | SEIGNOSSE                                | Cuvier's     | - 3         | 26            | 160          |
| Е      | 1980   | 06-apr-80  | А        | HOURTIN                                  | Cuvier's     |             |               |              |
|        | 1982   | 30-nov-82  | А        | BALEINES                                 | Cuvier's     |             |               |              |
|        | 1982   | 11-dec-82  | А        | VENDAYS-MONTALIVET                       | Cuvier's     |             |               |              |
|        | 1982   | 13-dec-82  | А        | SAINT-TROJAN-LES-<br>BAINS               | Cuvier's     |             |               |              |
|        | 1982   | 14-dec-82  | А        | SAINTE-MARIE-DE-RE                       | Cuvier's     | 8           | 40            | 100          |
|        | 1982   | 18-dec-82  | А        | SAINT-JULIEN-EN-BORN                     | Cuvier's     |             |               |              |
|        | 1982   | 19-dec-82  | А        | SAINT-PALAIS-SUR-MER                     | Cuvier's     |             |               |              |
|        | 1982   | 30-dec-82  | А        | VENDAYS-MONTALIVET                       | Cuvier's     |             |               |              |
| F      | 1983   | 10-jan-83  | А        | LA TREMBLADE                             | Cuvier's     | 1           |               |              |
|        | 1999   | 19-jan-99  | А        | BISCARROSSE                              | Gervais'     |             |               |              |
|        | 1999   | 30-jan-99  | А        | BISCARROSSE                              | Cuvier's     | 3           | 30            | 70           |
| G      | 1999   | 18-feb-99  | А        | SOUSTONS                                 | Cuvier's     | 1           |               |              |
|        | 2007   | 28-feb-07  | А        | QUIBERON                                 | Cuvier's     |             |               |              |
|        | 2007   | 01-mar-07  | А        | LA COUARDE-SUR-MER                       | Cuvier's     | 1           |               |              |
|        | 2007   | 26-mar-07  | А        | GUETHARY                                 | Cuvier's     | - 4         | 31            | 470          |
| н      | 2007   | 31-mar-07  | Α        | BIDART                                   | Cuvier's     | 1           |               |              |
|        | 2007   | 24-dec-07  | A        | LES SABLES-D'OLONNE                      | Cuvier's     |             |               |              |
|        | 2008   | 16-jan-08  | Δ        | SAINT-DENIS-D'OLERON                     | Cuvier's     | 3           | 26            | 70           |
|        | 2000   | 10-jaii-00 |          | SAINT-PIERRE-                            |              | 1           | 20            |              |
| I      | 2008   | 21-jan-08  | A        | D'OLERON                                 | Cuvier's     |             |               |              |
|        | 2008   | 07-mar-08  | Α        | MIMIZAN                                  | Cuvier's     | 4           |               |              |
|        | 2008   | 14-mar-08  | А        | SEIGNOSSE                                | Cuvier's     | 7           | 96            | 240          |
|        | 2008   | 12-apr-08  | А        | SOUSTONS                                 | Blainville's | 4           |               |              |
| Н      | 2008   | 14-apr-08  | А        | SOUSTONS                                 | Blainville's |             |               |              |

Details of the 63 beaked whale stranding events occurring in 'small series'

|   | 2008 | 20-apr-08  | А | BOURCEFRANC-LE-<br>CHAPUS | Cuvier's  |   |    |    |
|---|------|------------|---|---------------------------|-----------|---|----|----|
|   | 2008 | 04-may-08  | А | VIELLE-SAINT-GIRONS       | Cuvier's  |   |    |    |
|   | 2008 | 13-jun-08  | А | MIMIZAN                   | Sowerby's |   |    |    |
|   | 2008 | 19-sept-08 | А | LA FLOTTE                 | Sowerby's | 2 | 1  | 14 |
| I | 2008 | 20-sept-08 | А | LES PORTES-EN-RE          | Sowerby's | 2 | 1  | 14 |
|   | 1974 | 16-dec-74  | М | ILE-ROUSSE                | Cuvier's  |   |    |    |
|   | 1974 | 18-dec-74  | М | CENTURI                   | Cuvier's  |   | 6  | 7  |
|   | 1974 | 22-dec-74  | М | ALGAJOLA                  | Cuvier's  | 4 | 0  | 7  |
| J | 1974 | 22-dec-74  | М | ALGAJOLA                  | Cuvier's  |   |    |    |
|   | 1984 | 02-oct-84  | М | BORMES-LES-MIMOSAS        | Cuvier's  |   |    |    |
|   | 1984 | 06-nov-84  | М | HYERES                    | Cuvier's  | 3 | 21 | 39 |
| к | 1984 | 23-nov-84  | М | LA SEYNE-SUR-MER          | Cuvier's  |   |    |    |
|   | 2003 | 17-apr-03  | м | CARGESE                   | Cuvier's  | 2 | 7  | 0  |
| L | 2003 | 24-apr-03  | М | CARGESE                   | Cuvier's  | 2 | 1  | 0  |
|   | 2008 | 13-oct-08  | М | HYERES                    | Cuvier's  | 2 | 11 | 61 |
| М | 2008 | 14-oct-08  | М | SAINT-RAPHAEL             | Cuvier's  | 2 | 11 | 01 |
|   | 2010 | 25-mar-10  | М | ANTIBES                   | Cuvier's  | 2 | 1  | 0  |
| N | 2010 | 25-mar-10  | М | ANTIBES                   | Cuvier's  | 2 | 1  | 0  |
|   | 1975 | 04-sept-75 | N | COLLEVILLE-SUR-MER        | Sowerby's | 2 | 1  | 0  |
| 0 | 1975 | 04-sept-75 | N | COLLEVILLE-SUR-MER        | Sowerby's | 2 | 1  |    |
|   | 1987 | 28-aug-87  | N | SAINT-VAAST-LA-<br>HOUGUE | Sowerby's |   |    |    |
| Р | 1987 | 29-aug-87  | N | SAINT-VAAST-LA-<br>HOUGUE | Sowerby's | 2 | 1  | U  |
|   | 2008 | 19-jan-08  | N | SANGATTE                  | Sowerby's |   | 1  | 0  |
| Q | 2008 | 19-jan-08  | N | SANGATTE                  | Sowerby's |   | 1  | U  |