

# A preliminary note on the unprecedented strandings of 45 deep-diving odontocetes along the UK and Irish coast between January and April 2008

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## ABSTRACT

Between 13 January and 14 April 2008, 14 Cuvier's beaked whales (*Ziphius cavirostris*), five Sowerby's beaked whales (*Mesoplodon bidens*), four unidentified beaked whales and 22 long-finned pilot whales (*Globicephala melas*) were reported stranded in Scotland, Ireland and Wales. Concerns that an unusual mortality event had taken place prompted further investigations although most carcasses were deemed to be too decomposed for necropsy. Preliminary findings are presented here and some potential causes of death considered. Although the event had some similarities with atypical mass stranding events linked in time and space to mid frequency sonars, there were also two important differences. First, the geographic range of the event was very wide and second, the strandings occurred over a prolonged period of about three months. Both of these factors could be related to the fact that the mortalities occurred offshore and the carcasses drifted ashore. The cause(s) of these high number of offshore mixed-species cetacean strandings during this period remains undetermined at this time.

## KEYWORDS

Strandings, Monitoring, Conservation, Noise, north-east Atlantic, Europe, Cuvier's beaked whale, Sowerby's beaked whale, long-finned pilot whale

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## Strandings of deep-diving odontocetes during 2008

Between 13 January and 14 April 2008, there were unprecedented strandings of 14 Cuvier's beaked whales (*Ziphius cavirostris*), five Sowerby's beaked whales (*Mesoplodon bidens*), four unidentified beaked whales and 22 long-finned pilot whales (*Globicephala melas*) in Scotland, Ireland and Wales. Most were assumed to be dead upon stranding. In addition to those in the UK and Ireland, a mother and dependant calf

Sowerby's beaked whale stranded live at Calais, France on 19 January 2008: the mother died and the calf was lost alive back out to sea. Apart from a pair of pilot whales that stranded dead on Eigg in the Western Isles of Scotland on 12 March (although in different locations), all other animals stranded individually. All reported strandings of these species are documented in Table 1.

The first five strandings of Cuvier's beaked whales were reported from the Western Isles of Scotland in February 2008, but a further 40 strandings of deep-diving species have since come to light in Scotland, Ireland and Wales (Table 1). The animals have been found in varying states of decomposition and as far apart as Cork, on the south-west coast of Ireland, and the Moray Firth, in north-east Scotland (Figure 1a & b). Samples have been collected from three stranded Sowerby's beaked whales in Scotland. In two cases, the cause of death was found to be maternal separation. Further analyses are underway.

To date, the number of animals involved in the strandings in 2008 is unprecedented for pilot whales in Ireland and for Cuvier's and other beaked whales in Scotland and Ireland (Figures 2 and 3). For the UK, the annual average number of strandings over the last 12 years for the period January to April is approximately one Cuvier's beaked whale and five long-finned pilot whales (UK CSIP, 2007). Whilst the number of pilot whale strandings in the UK has been higher than the average since 1997, the same number of pilot whales (ten) stranded during this period in 2002, and nine in 1999. During the same 12 year period in Ireland, the annual average number of recorded strandings is approximately one Cuvier's beaked whale and less than three pilot whales (O'Connell & Berrow, 2007; IWDG website).

#### **Possible causes of death**

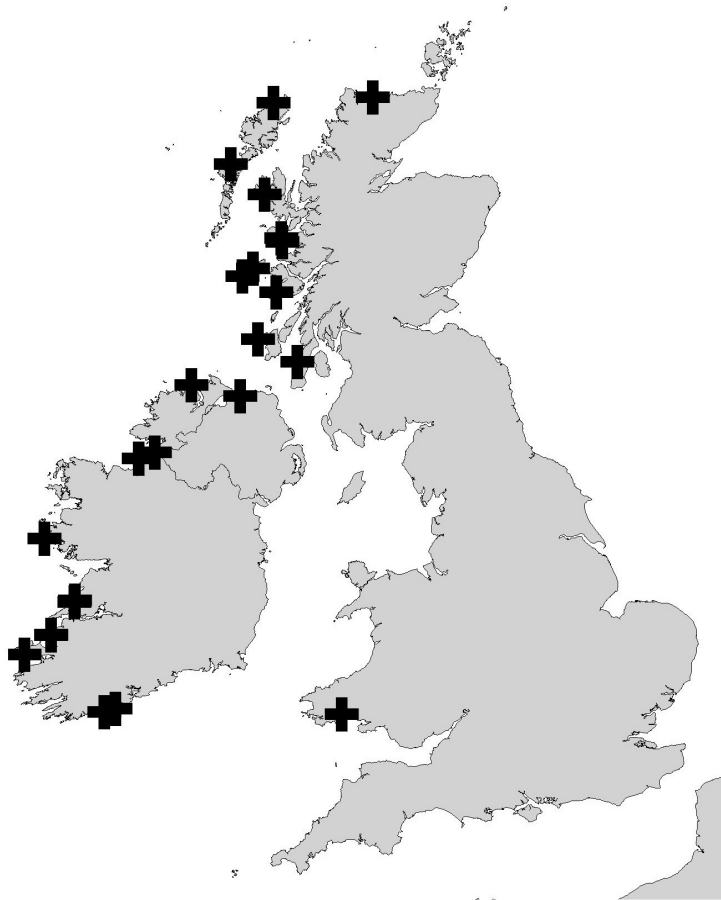
Concerns that an unusual mortality event had taken place were first raised following the strandings of five Cuvier's beaked whales (numbered 7, 8, 11, 12 and 16 in Table 1) on Islay, Tiree, Harris and Lewis in western Scotland over a 9-day period. Based on their presenting states of decomposition, the suspected time of death of these animals, as well as all Cuvier's beaked whales that subsequently stranded in Scotland, was around mid January (R.J. Reid, pers. comm.). The advanced states of decomposition meant that post-mortem was subsequently not possible.

Whilst the pattern of strandings reported here does not fit the 'atypical' event previously described - i.e. often involving more than two animals, of one or more species, stranding approximately simultaneously and alive but not in the same location (Frantzis, 1998; Brownell *et al.*, 2004) - the number of carcasses involved and combination of species involved is unprecedented in the UK and Ireland.

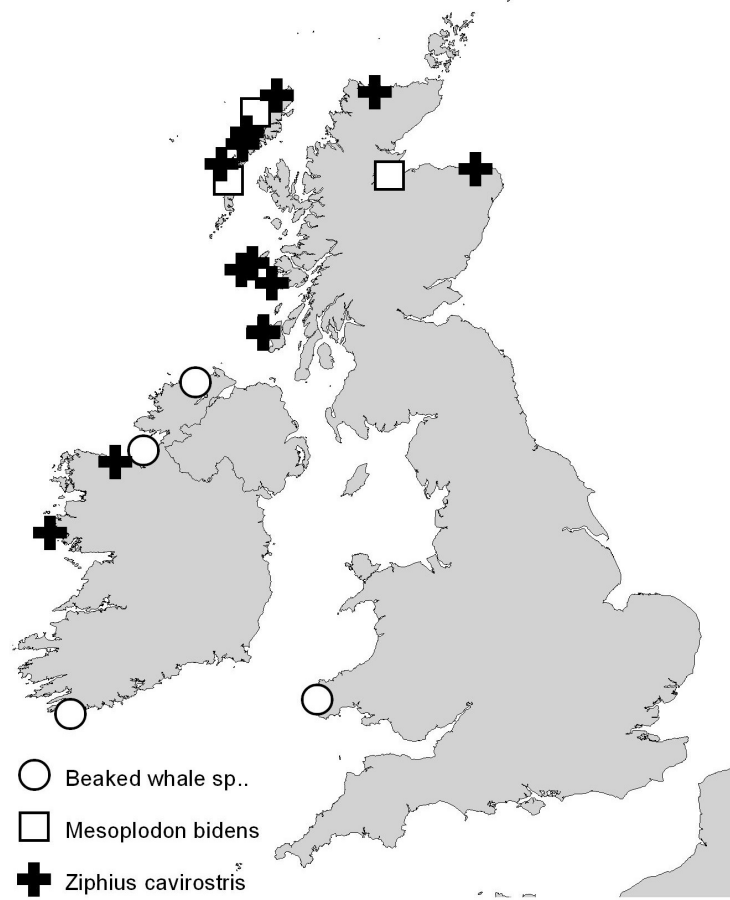
Many 'atypical' strandings of Cuvier's beaked whales in particular have been directly associated with mid frequency sonar (MFS) although it has not always been possible to fully investigate these events (Brownell *et al.*, 2004; Freitas, 2004; Martin *et al.*, 2004; Fernández *et al.*, 2004; 2005a; 2005b; Espinosa *et al.*, 2005; Fernández, 2006). Of particular note are the pathological investigations of four dead Cuvier's beaked whales found stranded and floating in the Canary Islands in July 2004 during the Majestic Eagle naval exercise, which occurred some 100 nm offshore, and which revealed some lesions consistent with those found in beaked whales that mass stranded live in the Canary Islands in 2002 also during a naval exercise (Fernández *et al.*, 2005a; Fernández *et al.*, 2005b).

Thirty-four short-finned pilot whales (*Globicephala macrorhynchus*), one minke whale (*Balaenoptera acutorostrata*) and two pygmy sperm whales (*Kogia breviceps*) stranded in a multi-species event in the Outer Banks of North Carolina, between 15 and 16 January 2005 (Hohn *et al.*, 2006). The US Navy was reported to be operating MFS in the region at the time of the stranding event. Although a definitive cause of this unusual mortality event was not established, the stranding had a number of features in common with other sonar-related strandings, for example, the 'atypical' distribution of strandings involving one or more offshore species, all stranding alive, and without evidence of common infectious or other disease processes (Hohn *et al.*, 2006).

(a)

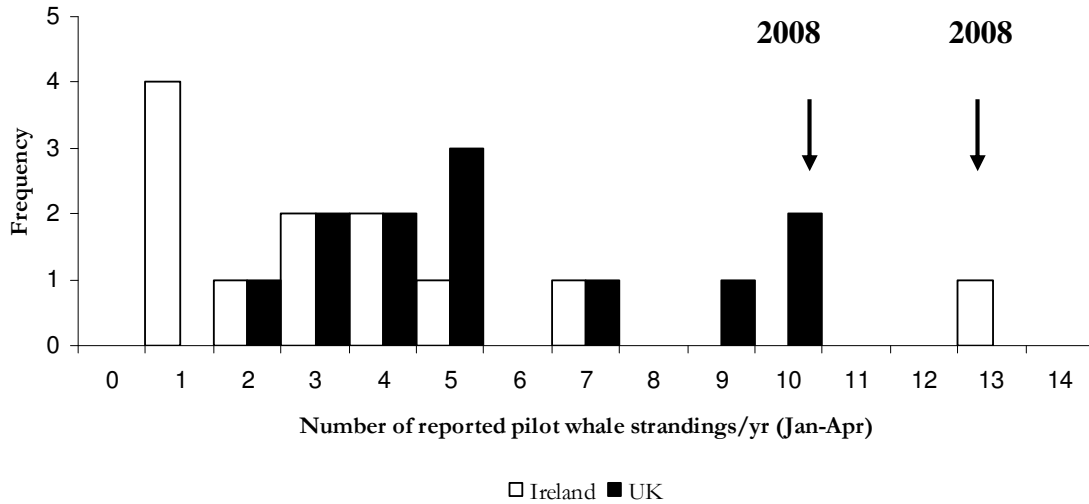


(b)

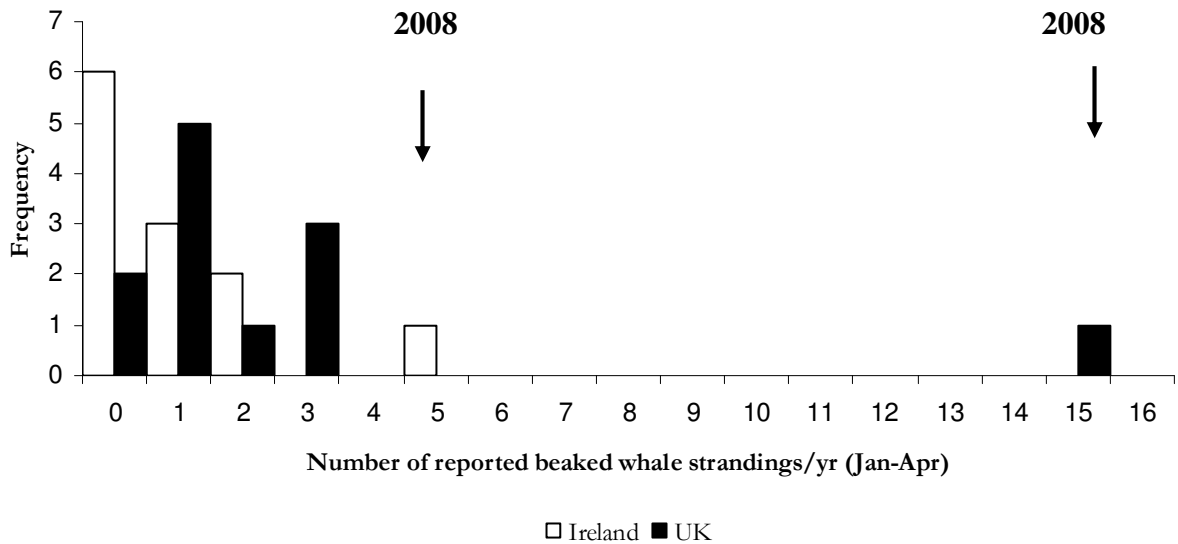


**Fig 1.** Stranding distribution of a) long-finned pilot whales and b) beaked whales on the UK and Irish coasts between January and April 2008

In many of the locations where atypical mass strandings have occurred, and to which MFS use or believed to be use has been associated (e.g. Japan, Puerto Rico, Bahamas, Canaries, northern Italy and Greece), the shelf edge is close inshore. Therefore if MFS had a lethal or sub lethal effect on beaked whales and other offshore cetaceans, they are more likely to live mass strand. In the UK and Ireland, however, the shelf edge is generally found further offshore, and any animals similarly affected would be more likely to die before reaching the coastline alive. However, correspondence between WDCCS and the UK Ministry of Defence (MoD) has confirmed that the Royal Navy 'did not conduct any activities involving the use of sonar around these waters during the period of the strandings...' but the MoD were not able to provide information about the activities of other nations in the Atlantic at that time (MoD e-mail response dated 08/04/08).



**Fig 2.** Frequency distribution for number of pilot whales stranded between January and April each year in Ireland and the UK, 1997-2008



**Fig 3.** Frequency distribution for number of Cuvier's and other beaked whales stranded between January and April each year in Ireland and the UK, 1997-2008

Behavioural responses have been detected in some species of cetacean in response to seismic activity (Stone & Tasker, 2006), although to date there is no evidence to suggest that this activity has resulted in the death of the deep-diving species under consideration here. In September 2002, two freshly dead Cuvier's beaked whales were found in the Gulf of California in Mexico, showing no signs of external trauma. The research vessel *R/V Maurice Ewing* was nearby conducting a seismic survey using an airgun array that produced higher intensity sounds (263 dB re 1 $\mu$ Pa @ 1m) than tactical sonar, although the peak frequencies were lower (100 Hz) (Taylor *et al.*, 2004). Whilst seismic surveying utilises lower frequencies than those used by beaked whales, recent studies have shown considerable energy at higher frequencies, increasing concern of the potential impact on odontocetes with poor low-frequency hearing (Madsen *et al.*, 2006). However, no seismic surveys were conducted along the west of the UK mainland between December 2007 and February 2008 inclusive (C. Bloomer, JNCC, pers. comm.). Seismic surveys occurred close to shore off northwest Ireland during December 2007 and January 2008 (S. Berrow, pers. obs.).

Furthermore, fishing activities have also been associated with the deaths of pelagic cetaceans, including beaked whales, which are documented as being vulnerable to mortality in pelagic drift-net fisheries (Read & Wade, 2000). There are no such fisheries in north-west European waters. Whilst both beaked whales and pilot whales are known to be taken as bycatch in other parts of the world, the recent deaths of long-finned pilot whales and beaked whales are not currently considered to be linked to fishing activities. Disease is another major cause of death in stranded species in the UK but the species involved are generally smaller odontocetes, including harbour porpoise (*Phocoena phocoena*) and common dolphin (*Delphinus delphis*) (UK CSIP, 2007).

#### **Current status of investigations**

Of the 45 strandings recorded, four necropsies have been carried out and histopathological examination of available samples is pending. Modelling of the Atlantic Ocean currents at the calculated times of death is also underway to aid identification of possible locations of the original five Cuvier's beaked whale mortalities. This information will then be used to run various scenarios to estimate where carcasses from this 'source' region would be likely to strand, i.e. does the pattern fit that subsequently observed in the other strandings. Should this modelling indicate a specific area where the whales may have died, then the MoD have stated that they will revisit their records to determine if there was any military activity occurring in this location at that time (MoD email response dated 08/04/08). Investigations into the cause(s) of the strandings in Scotland, Ireland and Wales, as well as the Sowerby's beaked whale in France, continue. Strandings continued up to the date of submission of this paper, with a pilot whale stranding on North Uist in western Scotland on 14 April as well as an unidentified beaked whale (probably Cuvier's beaked whale) being found in Kerry, Ireland on 7 May (M. O'Connell, pers. obs.). Both stranded in an advanced state of decomposition.

#### **INITIAL CONCLUSIONS**

Given the advanced state of decomposition of the majority of carcasses, little information is available to ascertain the cause(s) of death. It remains a possibility that a currently unidentified anthropogenic factor may have been contributory to these mortalities. Consistently strong onshore winds were reported by many of the stranding investigators and may also have been a factor in driving dead cetacean carcasses onto the shore. However, even if the wind played a role, this still leaves the question of why these animals died. Clearly, whales can die at sea, sink, refloat, drift, and be eaten by predators before or after stranding. Unfortunately, the decomposed state of many of the stranded animals means that the cause(s) of death may never be determined. A further question remains about the number of animals that died, as a greater number of carcasses may have also sunk out at sea. In addition, other natural or unrelated mortalities undoubtedly occurred during this unusual period (for example the pilot whale skull found on 13 January in Clare, Ireland is considered to be unrelated to this current unusual event).

Nonetheless, there are general lessons that can be learnt from these stranding events. Not least of all, the high value of dedicated strandings networks and those staff and volunteers that contribute to them. This allows investigators to quickly determine when the stranding rate deviates from the normal pattern and start searching for the cause of deaths. In addition, good communication between networks and the timely collation of as much stranding data as possible are key factors in identifying unusual cetacean stranding events and gaining a more detailed understanding of the environmental and other factors surrounding such

events. Furthermore, the importance of a properly funded and organised programme of post mortem examination of strandings, including deep diving species, was considered to be vital to drawing together strandings information efficiently and accurately. While it was noted that a programme currently operates in the UK it was noted that a similar programme did not currently exist in the Republic of Ireland.

Whilst lack of knowledge of the cause of this series of strandings is the biggest concern, the lack of suitable abundance estimates for these species in the North Atlantic in which the context of these deaths can be placed is also of concern.

#### **COMMENTS AND RECOMMENDATIONS**

1. The authors welcome the recent agreement by Department of Environment, Fisheries and Rural Affairs (DEFRA), UK government, to fund a web-accessed database of UK strandings data (such as that available on [www.iwdg.ie](http://www.iwdg.ie)). The integration of and access to CSIP data should enable more efficient dissemination of information between strandings networks to improve the early identification of any unusual mortality events that may occur in the future. It is hoped that the completion of this work will also facilitate closer co-operation with other European strandings networks and allow the earlier detection of unusual events that might take place across national boundaries, such as the one described in this paper. The creation of a European strandings database is a long-standing aim of the Agreement for the Conservation of Small Cetaceans in the Baltic and North Sea (ASCOBANS). It would greatly aid assessment of any future event such as that described here, and may help to identify any unusual historical stranding clusters across European waters. Such a database would also be a valuable contribution to other Regional Agreements, as they develop;
2. We recommend the development of a new system to determine priority cases for postmortem examination of beaked whales and other deep diving species without jeopardising current stranding priorities. Under the current system if these species stranded in a condition 2 (and possibly 3), postmortem examinations would most likely be carried out. There is scope for additional UK Government funding to be made available for investigating unprecedented cetacean stranding events, but the problem with this particular event is that it was not considered unusual until some time after the first carcasses had stranded. Maintaining a UK-wide overview of national cetacean strandings at all times, such as would be provided by the aforementioned database, would therefore be the best mechanism to ensure that research effort is targeted when and where it is required and at the earliest opportunity; and,
3. Given that strandings were still occurring at the time of submission of this paper to the IWC Secretariat, complete analysis should be undertaken at the end of 2008 and reported upon in the peer reviewed literature, including detailed results of the outstanding components of this investigation.

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**Table 1.** Strandings of deep diving species around the coastline of the UK and Ireland between January and April 2008  
*pw = pilot whale; sbw = Sowerby's beaked whale; cbw = Cuvier's beaked whale; unid. bw = unidentified beaked whale.*  
 IWDG = Stranding recorded by the Irish Whale and Dolphin Group; CSIP = Stranding recorded by Cetacean Stranding Investigation Programme; SAC = Scottish Agricultural College; MEM = Marine Environmental Monitoring

\*samples taken but full necropsy not undertaken;

\*\*lost at sea, could have re-stranded elsewhere at later date. Natural mortalities undoubtedly overlay unusual event.

Strand no.	Date	Species	Location	Number of animals	Condition	Source	Necropsy undertaken?
1	13-Jan	pw	Clare, Ireland	1	skull	IWDG	no
2	21-Jan	unid bw	Cork, Ireland	1	decomposed	IWDG	no
3	21-Jan	sbw	Moray Firth, Scotland	1 dependant	live stranded, euthanised	CSIP(SAC) WDCS attended	yes
4	21-Jan	pw	Kerry, Ireland	1	decomposed	IWDG	no
5	22-Jan	pw	Cork, Ireland	1	live stranded	IWDG	no
6	22-Jan	sbw	Fortrose, Scotland	1 dependant	live stranded	CSIP(SAC)	no
7	03-Feb	cbw	Islay, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
8	05-Feb	cbw	Islay, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
9	06-Feb	pw	Pembrokeshire, Wales	1	live stranded	CSIP(MEM)	yes
10	07-Feb	**pw	Islay, Scotland	1	slight decomposition (lost)	CSIP(SAC)	no
11	07-Feb	cbw	Tiree, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
12	07-Feb	cbw	Harris, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
13	08-Feb	pw	Cork, Ireland	1	neonate, decomposed	IWDG	no
14	10-Feb	pw	Galway, Ireland	1	decomposed	IWDG	no
15	11-Feb	sbw	Benbecula, outer Hebrides, Scotland	1 dependant	poor condition, but fresh	CSIP(SAC)	yes
16	12-Feb	cbw	Lewis, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
17	12-Feb	pw	Tiree, Scotland	1	dead stranded	CSIP(SAC)	no
18	13-Feb	unid bw	Pembrokeshire, Wales	1	decomposed, circa mid Jan	CSIP(MEM)	no
19	13-Feb	unid bw	Sligo, Ireland	1	decomposed, circa mid Jan	IWDG	no
20	17-Feb	pw	Donegal, Ireland	1	decomposed	IWDG	no
21	18-Feb	pw	Coll, Scotland	1	dead stranded	CSIP(SAC)	no
22	28-Feb	cbw	Galway, Ireland	1	dead	IWDG	no
23	02-Mar	cbw	North Uist, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no



24	03-Mar	pw	Skye, Scotland	1	dead stranded	CSIP(SAC)	no
25	06-Mar	cbw	Sligo, Ireland	1	decomposed, circa mid Jan	IWDG	no
26	08-Mar	pw	Kintyre Peninsula, Scotland	1	dead stranded	CSIP(SAC)	no
27	09-Mar	pw	Donegal, Ireland	1	decomposed	IWDG	no
28	12-Mar	pw	Eigg, Scotland	2	dead stranded	CSIP(SAC)	no
29	14-Mar	pw	Mull, Scotland	1	dead stranded	CSIP(SAC)	no
30	14-Mar	cbw	Mull, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	*yes
31	15-Mar	pw	Lewis, Scotland	1	dead stranded	CSIP(SAC)	no
32	16-Mar	pw	Kyle of Tongue, Scotland	1	dead stranded	CSIP(SAC)	no
33	19-Mar	pw	Kerry, Ireland	1	very decomposed	IWDG	no
34	22-Mar	cbw	Tiree, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
35	25-Mar	cbw	Moray Firth, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
36	26-Mar	cbw	Kyle of Tongue, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
37	28-Mar	pw	Clare, Ireland	1	very decomposed	IWDG	no
38	30-Mar	cbw	Lewis, Scotland	1	decomposed, circa mid Jan	CSIP(SAC)	no
39	31-Mar	cbw	Harris, Scotland	1	skull	CSIP(SAC)	no
40	02-Apr	unid bw	Donegal, Ireland	1	decomposed, circa mid Jan	IWDG	no
41	02-Apr	pw	Donegal, Ireland	1	skeleton	IWDG	no
42	04-Apr	pw	Kerry, Ireland	1	decomposed	IWDG	no
43	10-Apr	sbw	West Lewis, Scotland	1 dependant	live stranded, fresh	CSIP(SAC)	yes
44	13-Apr	pw	Derry, Northern Ireland	1	decomposed	IWDG	no
45	14-Apr	pw	Sligo, Ireland	1	decomposed	IWDG	no