Report on the mass stranding and rescue of common dolphins in Porth Creek, the Percuil River, Falmouth, SW England, June 2008

Photo: R Goodall

Compiled by Cornwall Wildlife Trust Marine Strandings Network and British Divers Marine Life Rescue.

May 2009

Report on the mass stranding and rescue of common dolphins in Porth Creek, the Percuil River, Falmouth, SW England, June 2008

Compiled by Cornwall Wildlife Trust Marine Strandings Network and British Divers Marine Life Rescue.

May 2009

Introduction

The mass stranding of a large group of common dolphins (*Delphinus delphis*), and death of 26 individuals, in Cornwall, southwest England on June 9th 2008 was unprecedented in the history of the county which has, in recent years, seen the greatest number of stranded cetaceans in the UK (source: Cornwall Wildlife Trust Marine Strandings Network and Cetacean Strandings Investigation Programme). This stranding represented only the fourth known mass stranding of common dolphins recorded in the UK since the systematic collation of UK strandings records began in 1913.

In total, approximately 40 common dolphins stranded or attempted to strand alive at various locations: Porth Creek (24 dead, one stranded/euthanased, approximately seven refloated), Gillan Creek (five to seven refloated), Place (one refloated) and Trelissick (one stranded/euthanased). Over the course of the day, over 70 animals are believed to have been guided out to sea by rescuers. One additional dead dolphin was reported on 11th June, although the species was unconfirmed and the body was not recovered.

A number of theories were proposed for the cause of the event, each of which was investigated by the UK Cetacean Strandings Investigation Programme (UK CSIP), assisted locally by Cornwall Wildlife Trust Marine Strandings Network (CWT MSN) and British Divers Marine Life Rescue (BDMLR). The results of the Defra funded CSIP investigation have also recently been published (Jepson and Deaville, 2009). The role of the CSIP report is predominantly to report on the findings of the pathology and consider the various hypotheses for causes of stranding and death put forward in light of what was found at post-mortem examination. The theories considered included pathological causes (such as disease and injury), acoustic disturbance, seismic activity and behavioural aberrations.

Although all theories were researched, the highest profile and most extensive event at the time of the stranding was a Royal Navy (RN) exercise, involving vessels from the navies of 7 other countries, which was in progress along the southwest coast. In recent years, mass strandings of cetaceans around the world, usually of beaked whales, have been linked to naval exercises using sonar and it was appropriate to examine the activities of the RN in this instance, to try to establish what effect, if any, their activities may have had on the dolphins.

As with any event of this nature, anecdotal reports play a part in helping to develop a picture of any factors that may have contributed to the event. However, it was not appropriate to include these in the CSIP report. This report, therefore, summarises the events leading up to and following the mass stranding event. It collates reports received from numerous eye-witnesses and other sources of what is known to have taken place in the days leading up to the event and on the day the animals were discovered (for a Timeline of events, see Appendix A). It elaborates on certain aspects of the CSIP investigation and considers whether there might be any substance to some of the theories about the cause of the stranding. Recommendations are made on how such events may be mitigated and responded to in the future.

Despite extensive enquires, there are many gaps in our knowledge of the event and we hope that this report will encourage eye-witnesses to come forward with their own observations at the time of the mass stranding so that we may come a step closer to finding the true cause.

Many volunteers, members of the public and members of the emergency services were directly or indirectly involved in the event, either through the rescue of the dolphins or by providing information for this report and it is only fitting that their tremendous contribution is acknowledged and recorded here.

Common dolphins around Cornwall

Common dolphins are frequently sighted around Cornwall and large groups of animals offshore are not unusual. They are normally a pelagic species, but in some years a high number have been bycaught in gill net, set close inshore. Strandings of common dolphins in Cornwall usually occur in the winter months, coinciding with the peak time of some trawl fisheries, in particular, with bass pair trawls. Strandings of this species are therefore rare in the summer (Figure 1).

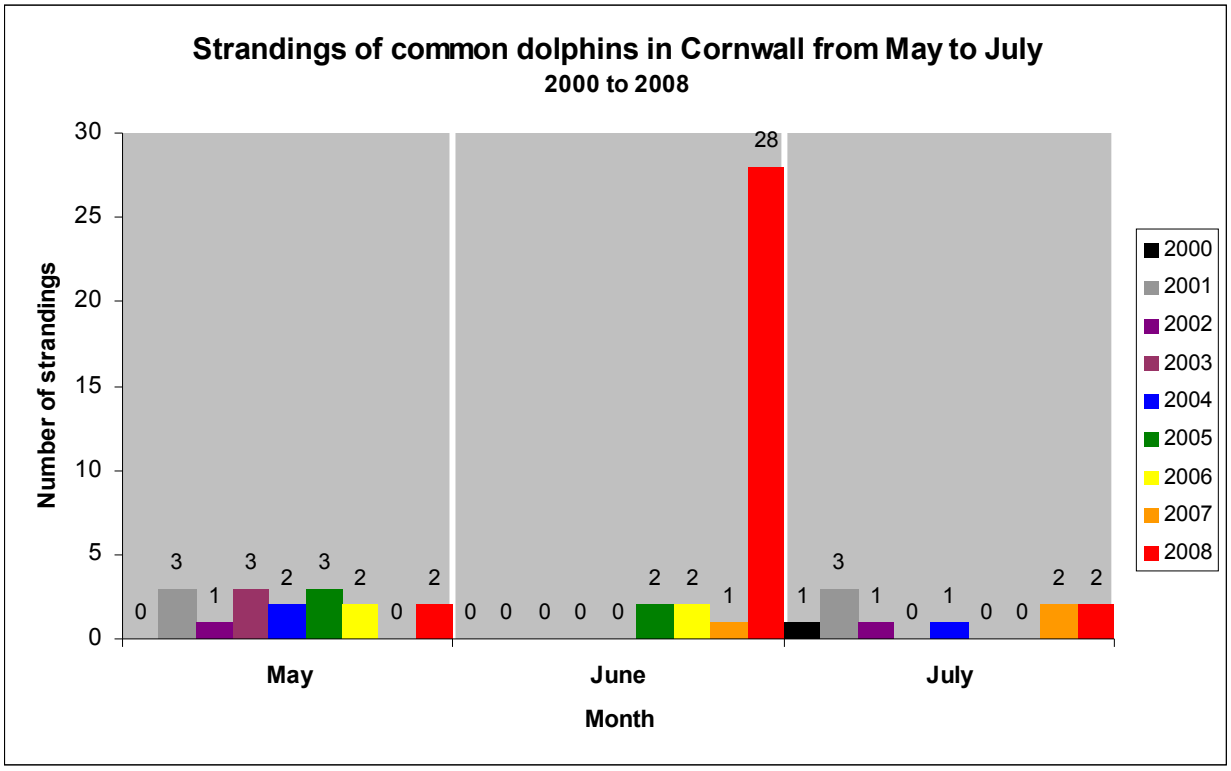

Figure 1: Strandings of common dolphins in Cornwall, May to July 2000 to 2008 (source: CWT MSN)

In 2008, a number of sightings of this species within Falmouth Bay were recorded, but few of them were logged very close inshore and none within the Fal estuary. A few days prior to the mass stranding, several groups of common dolphins had been sighted close inshore, including two dolphins seen in the Helford river on 7th June and 50 to 60 animals seen 0.25 miles off-shore near Porthcurnick on 8th June (source: CWT Sightings Database).

The location

Falmouth Bay and the Carrick Roads have numerous small river systems and creeks, including the Percuil River, River Fal and Helford River which are recognised for their mud and sand flats that are covered by water at high tide and exposed at low tide. The mass stranding event took place over a number of locations in this area, at Porth Creek, Place, Falmouth harbour, Trelissick and Gillan Creek (Appendix B).

At 33 metres in its deepest part, Falmouth harbour is the third deepest in the world. It is a busy port for leisure craft, cargo and military shipping and has a dockyard which carries out ship repairs.

Climatic conditions

The weather prior to and during the stranding event was settled and hot, with clear skies. The sea was calm, visibility was good and there was no unusual storm activity or adverse conditions likely to effect cetaceans (data: UK Met Office).

The mass stranding event

In total, approximately 40 common dolphins stranded or attempted to strand, alive or dead, at the various locations. Twenty-four animals were found to be already dead on discovery, approximately 13 were successfully refloated and two were euthanased.

Over the course of Monday 9th June, over 70 animals are believed to have been guided out to sea by rescuers. An additional dead dolphin was reported on 11th June at Gillan Creek, although the species was unconfirmed. This animal was not retrieved for post-mortem examination as the carcass washed out before the report was received. It has been assumed that all the animals involved were from one group of dolphins which broke off into several smaller groups at different times over the course of two days.

More detailed accounts by some of those involved in the rescue can be found at www.bdmlr.org.uk/index.php?page=reports.

Porth Creek

At approximately 0800 hours on 9th June 2008 (around 2.5 hours before high water), a groundsman working at Froe, the sole house at the head of Porth Creek, saw a dead dolphin in the water in the corner of the creek, opposite the house (Appendix C). He called the Maritime Coastguard Agency (MCA) at Falmouth and the MCA sent a boat to investigate. Cornwall Wildlife Trust's Marine Strandings Network (CWT MSN) was also alerted at approximately 0815 hours via its Strandings Hotline and they put in a call to the Area Coordinator of British Divers Marine Life Rescue (BDMLR). Both organisations immediately sent trained volunteers to the location.

Porth Creek, Percuil River. Photo: J Loveridge

Those first on the scene, a CWT MSN volunteer and her friend, made their way along the left bank and found five live dolphins stranded in shallow water. They waded in and turned four of the dolphins back into the water and released them. The fifth was listing heavily to one side and had to be supported in the water to keep its blowhole above the water line. A number of live dolphins were seen free-swimming in an agitated manner in the creek.

The Royal National Lifeboat Institute (RNLI) local inshore lifeboat was deployed and arrived at around 0930 hours. On entering the Percuil River, they discovered a large group of dolphins, some swimming among the yacht moorings and the rest at the mouth of the creek. As they proceeded up Porth Creek, they saw that there were also some live dolphins in the shallow water. They assisted one dolphin stranded in the shallows that showed signs of wanting to return to the free-swimming group, which eventually it did.

The bodies of 11 dead dolphins floating belly-up, or beak-up, at various sites up the length of the creek, were counted by the groundsman and RNLI. Some were at the edges of the water while others were floating on the incoming tide which, by that time, was about an hour before high water. On 9th June high water was at 1042 BST (0942 UTC) at Falmouth. Due to the high pressure system present at the time there would have been a small difference in tide times at the creek and tide heights would probably have been slightly lower than published.

The groundsman had also seen one dolphin swimming in circles among the bodies close to the head of the creek and approximately seven more, including a mother and calf, were swimming up and down the creek in the shallow water. Due to their size, they were thought to be juveniles. Those seen by rescuers at the head of the creek were described as "squealing in panic" and some of the dolphins could be heard clicking.

BDMLR arrived with their rescue equipment and made contact with the RNLI Team and St Mawes Assistant Harbourmaster who were also on the scene. The BDMLR Coordinators and Marine Mammal Medic volunteers then joined the rescue effort, together with more CWT MSN volunteers, Cornwall County Fire Service, local boatyard and King Harry Ferry staff and members of the public. The rescue and retrieval of the dolphins then continued over the next five to six hours.

Two male dolphins attended by BDMLR Medics and vet. Photo: T Bain

The listing dolphin was placed on a bed of seaweed to protect her from the rocky shore and when the tide began to fall, she was transferred to one of BDMLR's specially designed pontoons which supported her in the water. The two dolphins on the right bank, both males, were stabilised by a BDMLR vet. One was quite vocal, the other silent. An attempt had been made to refloat one of these animals, but it stranded again, so it was placed in a pontoon and shaded from the sun. Having assessed both animals, the vet judged that the second dolphin was too severely compromised to be released and the decision was made to euthanase it.

It was essential to move the dolphins out to deeper water before the tide began to recede, so both pontoons were attached to boats and taken slowly downstream. As one of the dolphins was very vocal and constantly clicking, the pontoon was turned to face upstream towards the free swimming dolphins in the hope that they would follow its whistles and clicks. This strategy appeared to work well, as the dolphins swam close to the RIB to scrutinise the dolphins on the pontoons and followed the boats as they proceeded downstream.

At the mouth of the creek, 25 to 30 dolphins were still swimming around in a disorientated manner. Interestingly, these also joined the group from the creek that were being led out by rescuers. A barrier had been formed by a number of boats, including those of the Fire Service, RNLI, local boatyard and kayakers, to prevent the dolphins from returning to the shallow water of the creek, or from going further up the Percuil River, as the tide by this time was receding. Rescuers in the boats used paddles and their hands to slap the water to deter the dolphins from turning back. This strategy worked well, although efforts to guide the dolphins to deeper water were severely compromised by a media helicopter hovering low above the group. This caused an adverse reaction among the dolphins, causing them to head back up the creek and severely disrupted communication between the boats. Eventually, the helicopter was requested to back away by the MCA and the rescue continued.

The flotilla of rescue boats, Percuil River. Photo: C Curtis

The rescue operation with vocal dolphin on a pontoon. Photo: T Bain

As they approached the beach near Place, rescuers saw another pod of about 30 to 40 dolphins attended by other rescuers and stopped for fear of driving them onto the beach or back up-river. Other boats quietly positioned themselves to prevent this and the procession continued out to deeper water. At St Antony Head, the two dolphins on pontoons were released together. The female listed slightly and seemed to hesitate initially, but soon gained strength and swam off strongly in the direction of the main group. The male swam around the boat then moved off to join the rest of the pod. One single dolphin went far in front of the flotilla. Rescuers described it as appearing "to lead the way" and as the boats got nearer to the open sea, the pod of dolphins following behind passed through the flotilla and went about 100 metres ahead. The disorientated behaviour of the dolphins was seen to change noticeably once they reached this point and they began breaching and swimming more strongly with a greater sense of direction.

While rescue efforts continued in the creek, the task of collecting the 24 dead dolphins and the euthanased dolphin carried on, while the tide was still in and the bodies were buoyant. The carcasses were brought ashore by volunteers and members of the public to the slipway at Froe where they were hauled out and recorded by the CWT MSN, assisted by the National Trust and a member of the public. Seven animals were subjected to post-mortem examination on the beach by the CSIP (Institute of Zoology and Marine Environmental Monitoring), Veterinary Laboratory Agency - Polwhele (VLA) and Wildlife Veterinary Investigation Centre staff that evening and eight animals were taken by the CWT MSN to the Veterinary Laboratories Agency (VLA) in Truro for post-mortem examination. The following day, four more were examined at post-mortem on-site and the remaining six animals were taken back to the Institute of Zoology (IoZ) in London for subsequent post-mortem examination.

Dolphins heading for the open sea. Photo: T Bain

The dolphins are prepared for transportation to post-mortem examination. Photo: R Goodall

Place

Builders working on a property at Place, on an inlet opposite St Mawes (Appendix B), observed an unidentified animal flapping around on the shore of Cellars Beach at approximately 0815 hours on Monday 9th June. On closer inspection they found it was a common dolphin stranded on the mud in shallow water. One of the builders assisted the dolphin and steered it into deeper water, walking with it for a short time then guiding it out. It tried again to strand, but he steered it back and eventually it joined a group of between 30 to 50 dolphins that had by then swum into the inlet, possibly from the mouth of Porth Creek. These animals appeared to be distressed, as they were tail slapping, leaping sideways, vocalising and continually swimming in circles with frequent changes of direction – a familiar behaviour in mass strandings described as "milling". One large, lone animal had been seen at the entrance to Place. Eye-witnesses said that it appeared to be waiting for the other dolphins, as if attempting to show them the way out to deep water, but they were reluctant to join it.

A team of rescuers, led by BDMLR volunteers, organised a number of boats to form a line, slowly herding the dolphins out to deeper water. A second team on the shore followed the course of the boats to make sure that none of the animals stranded. As the line reached deeper water, the rescue boats from Porth Creek, with the two dolphins on pontoons, came past, followed by the free swimming dolphins from the creek. When the animals from Place noticed the other dolphins, they took off after them and made for the open sea. Their behaviour was also seen to change markedly at this point, from agitated to breaching and swimming strongly.

Falmouth Harbour

A report of more common dolphins in Falmouth harbour was received by the CWT MSN Hotline at 0930 hours. There were also reports of small groups or pairs of dolphins out in the main river channel and out in the estuary channel. BDMLR was alerted and a team of Medics was sent to investigate.

Orca SeaSafaris (a wildlife-watching boat) had witnessed approximately 15 dolphins coming into the harbour between Trefusis Point and Falmouth docks at around 0950 hours. The animals were exhibiting unusual behaviour – swimming at speed in a direct line past the boat and not stopping to interact with it as they usually did offshore. Instead, they headed straight for the Prince of Wales pier and turned left into Custom House Quay and the inner harbour (Appendix B).

Approximately 10 to 15 dolphins, including a very young calf, were observed by BDMLR Medics and Falmouth Harbourmaster within a small area in the marina, in the inner harbour. They described them as "confused and circling". The dolphins made no attempt to dive under the boats to reach deeper water.

Dolphins in Falmouth harbour. Photo: S Bone

Over the course of the day, one would occasionally break away from the main group and on three occasions, two dolphins attempted to strand. They were seen to "charge at speed" two or three times towards the harbour slipway, with the rest of the group behind them, almost beaching themselves in the shallow water but turning away at the last moment.

In consultation with the Harbourmaster, BDMLR volunteers made two attempts to herd the dolphins out of the harbour. A carefully coordinated formation of boats slowly moved forward and the dolphins responded positively, moving together straight towards the exit point. They once again tried to turn back as they approached the corner, but then quickly headed along the seafront and into a more open area away from the marina. As the dolphins were now heading downstream, more boats ahead of them were coordinated to divert them out into the yacht marina and closer to the main channel. Gradually, the pod moved into a deeper area behind the marina next to Falmouth Dockyard, which is adjacent to the main channel. Later in the day, they became trapped in an enclosed area of this marina and a second herding attempt was made by BDMLR in the early evening using several boats in formation. The dolphins were encouraged out into the main river channel to deeper water by the dockyard, but then dived under the boats moored in this marina, so returning to where they started. The herding attempt was terminated in order not to stress the dolphins further, particularly as a mother and calf were among them, but the dolphins dived back under the boats to the deeper, open water again and remained there.

The animals were monitored by a team on the quayside until dark and overnight they made their own way out of the harbour. The river, estuary and surrounding coastline were checked early next morning for any further strandings or sightings, but none were found.

Trelissick

At 1630 hours, the CWT MSN Hotline Coordinator received a call reporting a live-stranded common dolphin at Trelissick, on the River Fal (Appendix B) and alerted BDMLR. The animal was unable to keep its head above water to breathe and its respiration rate was poor. Volunteer Medics supported the dolphin in the water while BDMLR vets conducted a physical examination. A white discharge was coming from its blowhole and its breathing was shallow. The vets attending the dolphin assessed that it clearly would not survive and as a result a decision was taken to euthanase it. The animal was taken to the VLA for post-mortem examination.

Two other dolphins were observed in the river, followed very closely by what was believed to be a TV film crew, but fortunately they did not strand. Fifteen dolphins were seen in this area the next day (King Harry Ferry, pers comm BDMLR).

Gillan Creek

Also at around 1630 hours, residents on the Lizard witnessed a group of dolphins entering Gillan Creek on the Helford River (Appendix B). Resident 1 was fishing from his boat, about one hour before low water, when they appeared. He observed that they seemed "distressed, disorientated and were milling about", but were not vocal. They had no injuries or scars and were fat and healthy animals. He observed two groups of dolphins, one of around five and another of around seven animals, which swam back and forth.

Residents 2 and 3 recall that five to seven of the dolphins appeared to be trying to "get away from the open sea". They swam around approximately twenty feet from the shore and repeatedly came into very shallow water and tried to strand on the sand bank in the creek. One of the dolphins was described as "exhausted". A dolphin was observed by one resident apparently "trying to show the others the way out to open water". It repeatedly swam towards the mouth of the creek then came back to the group, but they appeared to the rescuers to be reluctant to leave. The residents turned the animals back into the water and splashed with paddles to prevent them from stranding.

Using four small boats and dinghies, the residents rounded the dolphins up and gradually, over the course of approximately four hours, steered them towards the sea. One live dolphin was seen in the Helford River the following day and an apparently dead dolphin was reported on 11th June by a RN helicopter pilot, although the species of this animal was not confirmed and it was not found, so could not be retrieved for post-mortem examination. No other common dolphins were reported.

Dolphins at Gillan Creek. Photo: S Smith

Timing of the event

The precise timing of the onset of the mass stranding in Porth Creek has not been identified and, to date, no reports of sightings during the afternoon or evening of Sunday 8th June or the early morning of Monday 9th June (sunrise was at ~0500 hours) have been received.

The approach to Porth Creek, along the Percuil River, passes the village of St Mawes. The mouth of Porth Creek is close to a residential area, two boatyards and a large number of boat moorings, some of which would probably have been occupied. On Sunday evening, sunset was at approx 2200 hours and there would have been plenty of light at that time for the dolphins to have been seen in the Percuil River. They also would have been audible, if vocal, which is possible if they were in a state of panic.

On the night of 8th June, a member of BDMLR was on a river cruise from Falmouth to the Helford River. There was nothing unusual in the number of vessels present, it was very calm, good cetacean spotting weather, but no dolphins were seen in the area between early evening and midnight (P. Jarvis, pers comm).

As no sightings reports have been received, it therefore seems unlikely that the stranding event occurred before dark on the 8th June. This places the onset of the mass stranding between approximately 2200 on Sunday and 0800 on Monday.

Porth Creek is tidal, with a very small channel and mud banks at low water. By examining tide times and heights, the time window for the mass stranding event may be narrowed further (Figure 2). Published tide times and heights for Falmouth on the 8th and 9th June were: high water 5.1 metres at 2152 hours BST (2052 UTC) on Sunday evening, low water 1.1 m at 0432 BST (0332 UTC) and high water 4.9 m at 1037 (0937 UTC) on Monday morning. There would have been a small difference in tide times at the creek and tide heights would probably have been slightly lower than published due to the high pressure system present at the time.

All dead animals were found floating in the creek. This suggests strongly that they stranded in the creek and not in the Percuil River or at the mouth of Porth Creek. If they had stranded at the mouth of the creek at any state of the tide, it seems probable that carcasses would have been found up the Percuil River on the incoming tide, or floating downriver on the outgoing tide, but none were found here.

The dolphins in the creek were first discovered about 2.5 hours before high water (about half-tide). Witnesses who first discovered the animals say that they were all floating - none was seen beached on the banks. If the animals had stranded on the mud at high water (2152 BST on Sunday 8th), they would still have been there at 0800 hours on 9th. As no animals were found stranded high on the bank, they could not have stranded at high water or indeed at any time approximately 2.5 hours either side of high water, from 1922 BST Sunday to 0022 BST Monday. This now places the mass stranding onset between approximately 0022 and 0800.

If it is further assumed that the animals could not have entered the creek at low water (0432 BST), the event must therefore have occurred either in the early hours of Monday morning, or just before they were found at approximately 0800 hours.

In the earlier scenario, the dolphins could have arrived in the creek during darkness and stranded on an outgoing tide, perhaps in the channel or on the lower parts of the mud bank, and been stranded for five to eight hours before being discovered. When the tide returned, those that had died could have been lifted off the banks and so were found floating. However, in this scenario, a higher number of deaths might have been expected, as the animals would have been stranded for longer.

In the later scenario, the dolphins could have entered Porth Creek on the incoming tide, perhaps from about 0630 hours onwards. Although it would have been light from this time, there are no eyewitness accounts to confirm this.

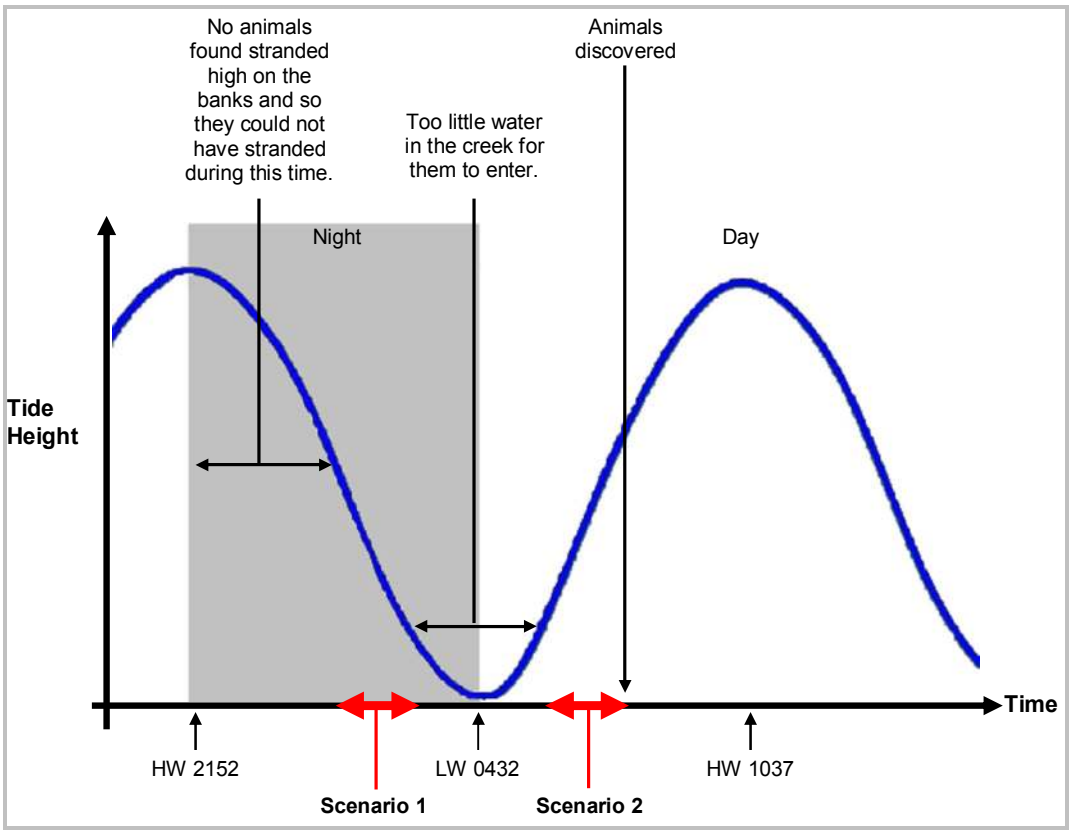

Figure 2: Possible times of the mass stranding (CWT MSN)

The pathology showed that the stress of stranding resulted in the rapid onset of stranding myopathy – a condition found in live-stranded or captured dolphins in which there is a breakdown of skeletal and cardiac muscle caused by trauma, struggling and crushing. If prolonged, this can result in kidney damage due to myoglobin from damaged muscle being transferred in the bloodstream to the kidneys, where they can be toxic. As little or no myoglobin was found in the kidneys of the dead dolphins, the pathological findings are consistent with a relatively quick (acute) death (Jepson and Deaville, 2009). In addition, some animals showed evidence of asphyxiation due to inhalation of mud and water. The stranding myopathy may have been sufficient to render the dolphins incapable of movement – including lifting their heads to breathe as the tide rose (as was seen in the dolphin at Trelissick), causing them to drown. It may also have been this condition that was affecting the dolphins that were listing in the water.

These findings appear to indicate that all 26 dead dolphins examined probably stranded alive and died relatively quickly afterwards (Jepson and Deaville, 2009). The fact that water was able to enter the blowhole suggests this happened on a rising tide and the state of decomposition points to stranding sometime between approximately 0630 and 0800 hours when they were found, although the earlier scenario cannot be excluded. Full details of the post-mortem examinations can be found in the UK CSIP report (Jepson and Deaville, 2009).

The timing (1630 hours) and location of the attempted strandings at Gillan Creek suggests that these dolphins may have been animals that broke away from the combined groups rescued from Porth Creek and Place. Video footage of the dolphins from Place shows some animals had a distinct pale pigmentation on their dorsal fins, which was also seen on the animals at Gillan. This could suggest either that the two groups were related, or possibly that they were the same animals.

Theories about the cause

A number of theories to explain the stranding were considered and investigated:

Following a sick leader/committing suicide

The theory that dolphins follow a sick leader and strand is often quoted in relation to mass strandings, but in this incident all animals were found to be healthy and disease-free on post-mortem examination. No evidence of bycatch or other physical injury, such as vessel strike, was found on any of the animals examined at post-mortem (Jepson and Deaville, 2009) or seen on photographs or video footage of those that were successfully rescued. Common dolphins are a highly social species and the mass suicide theory does not explain why they split off into separate groups and congregated at different locations, in preference to staying with a "sick leader" in the Helford River, but instead moved further north. In such a confusing location, however, it is possible that a large group could become fragmented, despite their social bond. It does not however, provide a reason why, if the animals were intent on "committing suicide", they made their way past numerous obstacles to strand up a shallow creek in preference to stranding on one of the many beaches of Falmouth Bay.

It was suggested that the dead dolphin seen in the Helford River on 11th June, could have been a sick leader which the rest of the group had followed. This was the only animal not to have been retrieved for post-mortem examination for cause of death, so was potentially the only animal to have been sick, since all others were healthy (Jepson and Deaville, 2009). However, it was reported by a Royal Navy helicopter pilot and the species was unconfirmed, so it could have been the live animal seen the day before.

Also, there is no explanation for the distance between the sites of stranding if this was the "leader"; that is, the main group would have been expected to strand with this animal at Gillan - as is the pattern observed in other mass stranding events where animals are sick - rather than 12 km away. It is more likely that this dolphin was one of those that attempted to strand at Gillan Creek and did not survive.

It may be significant that, at both Place and Gillan Creek, a lead animal was described by several observers apparently trying to show the other dolphins the way to open water and that no individual 'leader' was seen directing the dolphins to strand after the rescue attempt.

Fleeing predators

Killer whales (*Orcinus orca*) are known to predate on common dolphins. The nearest reported sightings of killer whales just before the mass stranding were in waters off west Wales and northern Scotland (data: Seawatch Foundation). The reporting of sightings of cetaceans to the Cornwall Wildlife Trust is proactive and an extremely rare sighting of orca would very likely have been reported. Therefore, this theory is not considered credible.

Bottlenose dolphins (*Tursiops truncatus*) have also been known to attack common dolphins and other species. In recent years a number of stranded animals, of several different species, retrieved by the CWT Marine Strandings Network for post-mortem examination by the CSIP, have been found to carry the typical signs of bottlenose attack (Barnett, et al, In Press). On 8th June at 1722 hours, Marine Mammal Observers (MMO) aboard the Royal Navy ship HMS Enterprise logged a sighting of two bottlenose dolphins in Falmouth Bay, 25 miles from Falmouth (source: Naval Service FOIA Cell). Two animals of this species were recorded on 7th June at Hand Deeps, approximately 8 nautical miles SW of Rame Head, near Plymouth and a further sighting in Mounts Bay near Penzance was received on 11th June (source: CWT Sightings Coordinator). It is not known whether these were the same animals or a different group, on each occasion.

It was suggested that the bottlenose dolphins seen by the RN in Falmouth Bay could have been a possible trigger for a panic reaction among the common dolphins that led to the mass stranding event. However, there is some doubt over the correct identification of the species and it is possible that bottlenose dolphins may have been confused with striped or common dolphins.

No sightings of bottlenose dolphins in the Fal estuary were received by CWT before, during or after the mass stranding event, despite there being numerous observers present, and no rake (tooth) marks inflicted by bottlenose dolphins were found on the stranded common dolphins or seen on any of those that were refloated or rescued.

Although bottlenose attack could, theoretically, have caused a panic reaction, there is insufficient evidence to support the theory that this species was in the immediate area at the time. No mass stranding event, in any part of the world, has been linked to bottlenose dolphins attacking other species and all deaths attributed to bottlenose attack have been of individual animals, not large groups.

Chasing prey

Another possible cause suggested was that the dolphins stranded while chasing prey up into the river system and became disorientated. However, although Porth Creek was described by the first rescuer on the scene as "teeming with mullet", the dolphins' stomachs were all found to be empty on post-mortem examination, suggesting that they had not fed for some time. Despite this, the post-mortem examinations confirmed that they were in good body condition, suggesting that they had not previously had problems locating prey, but more recently they had been unable or unwilling to feed.

Dockyard noise

Falmouth harbour is the third deepest harbour in the world and its dry-water dockyard receives many large vessels for repair and so noise from the dockyard was considered as a potential trigger of the event. However, the dockyard has been in existence for over 100 years without incident and it confirmed that no unusual activity was taking place and no excessive noise was being created at the time of the mass stranding (pers comm). Also, the dolphins that were seen fleeing into the inner harbour were heading towards the docks, not away from them. The dockyard was therefore not considered a likely candidate as a trigger of the dolphins' flight reaction.

Seismic activity

The UK Department of Energy and Climate Change (DECC) confirmed that no geophysical surveys were licensed to take place in the English Channel or Southwest Approaches or in any adjacent sea area, either prior to, or during, the stranding event. A research vessel (RV Celtic Explorer) was conducting a high-resolution 2-D seismic survey in the Celtic Sea south of Cork, but this was over 200 km from the mass stranding event with an intervening land mass (data: Marine Institute). This theory has therefore been excluded as a possible cause.

Navigational error

It is not known why these pelagic dolphins, which seldom come close to the shore, entered the Fal estuary. Possibly they found themselves penned in to Falmouth Bay by the naval exercise or some other disturbance and were forced to follow a stretch of unfamiliar coastline in an attempt to find an escape route, during which time they were alarmed by something and fled away from the source. If the dolphins had followed the coast from the east, and fled into Porth Creek away from the source of the disturbance, they would have found themselves in very shallow waters, totally unlike their normal habitat, possibly leading to disorientation. In previous mass stranding events, cetaceans have been observed to swim at speed in a straight line, apparently away from the source of disturbance, ignoring the presence of humans (Bob Brownell, pers comm). Similar behaviour was observed in one group of common dolphins

heading into the harbour. It appears that all animals that entered the Fal were in a state of mass panic and behaving abnormally. So, possibly it was not so much a navigation error on the part of the animals that led them into an un-navigable creek, but rather an event that forced them to react *en masse*, and enter unfamiliar habitat. Unfortunately, no witness of the original trigger of this panic reaction has yet been found.

Disturbance

The question of whether there was an unusual amount of leisure-boat or power-boat activity taking place prior to the event, or whether there were unusual vessels visiting or mooring up in Falmouth harbour, which may have had an effect on the dolphins, was considered. Enquiries were made to the Maritime Coastguard Agency in Falmouth on this point and they confirmed that there was no unusual shipping activity in the area (Jepson and Deaville, 2009). It may be significant that a number of large scale events, such as the Tall Ships Race, are regularly held in Falmouth without any apparent adverse effects on cetaceans. However, it should be recognised that there is a possibility that a mass stranding event could occur as a result of such events, if a combination of dolphins in the vicinity and a negative stimulus were to coincide.

All shipping uses sonar for navigation. However, unless there was something unusual in the type or strength of sonar used by commercial or pleasure vessels in Falmouth Bay at the time – and there is no evidence to suggest this was the case – it is considered unlikely to have played a role in the mass stranding.

Naval activity

At the time of the event, a Royal Navy exercise was taking place along the south-west coast. Up to 20 warships, including vessels from Holland, France, Germany, the USA, Belgium, Chile and Denmark were involved in a training exercise covering a wide area from Dorset to Cornwall during the period 1st to 9th June (Appendix D and E, source: Naval Service FOIA Cell). At least one nuclear submarine was also reported to be taking part.

The South Coast Exercise

The exercise was described as a Flag Officer Sea Training (FOST) event which takes place in the South Coast Exercise Areas (SCXA) for 46 weeks of the year. Practical training, conducted on a weekly basis, consists of two, 3-hour Single Threat exercises which employ Medium Range Sonar (MRS). Sonar activity is reported to be contained within the SCXA in areas Foxtrot, Golf and Hotel. The closest edge of area Foxtrot to Falmouth Harbour is approximately 24 nautical miles. According to the RN, submarines are usually instructed to loiter between areas Golf and Hotel some 30 miles or so east of the harbour (RN, pers comm).

This exercise was taking place in addition to practical training – an event familiar to locals and know as "Thursday Wars". This is conducted on a weekly basis and also consists of two, 3-hour Single Threat exercises, normally conducted during specific periods and allocated areas, again employing MRS. It covers most, if not all, the available areas (source: RN, pers comm).

These combined extensive exercises may explain why local people in the Falmouth area described the naval operation as much larger in scale and more prolonged than usual. For the RN, the exercise was described as at a "generally normal level of activity". It reported that the peak of naval activities was on the 4th and 5th June, prior to the mass stranding.

Five to six vessels were in operation at the time of the mass stranding (the maximum for this exercise being seven), although the MoD did not disclose specifically which specific vessels were deployed in the area, precisely where they were in operation, or in what way they were active.

Submarine activity

Antisubmarine warfare (ASW) activities using mid-frequency sonars (2 - 4 kHz and 5 - 8 kHz) were reported by the RN to have been conducted in the areas Foxtrot, Golf and Hotel at least 45 - 50 km from the stranding locations in Falmouth Bay, up to 6th June (Appendix D and E, source: Naval Service FOIA Cell). This was approximately 60 hours before the discovery of the stranded dolphins (RN pers comm). However, the Maritime Coastguard Agency had issued a warning to shipping about "extensive submarine activity" in Falmouth Bay North, from Sunday morning (8th June) to Monday midday (9th June) (source: Times Online).

A request for more clarity, under the Freedom of Information Act (FoIA), asked the MoD what submarine/anti-submarine activity, using either active or passive sonar, was taking place in Falmouth Bay between 1000 hours on Sunday 8th June and 1500 hours on Monday 9th June. The RN confirmed that a submarine was operating in the Southern Exercise Area, including Falmouth Bay, throughout 8th June (the exact time and form of activity was not specified) and from 0900 - 1500 on 9th June, using an echo sounder at 50 KHz and passive sonar and in the area off Coverack on 10th June. However, the RN stated that anti-submarine warfare activity, using active sonar, did not recommence until 1500 on 9th June, after the mass stranding had taken place (source: Naval Service FOIA Cell).

Multibeam sonobuoys were also used in the naval exercise, although their deployment ceased before the estimated onset of the mass stranding. Media reports said that sonar "dipper" devices were used seven times by Merlin and Lynx helicopter crews in the week before the incident. These devices are dropped from helicopters or fixed wing aircraft into the sea and if active, emit a ping at 10 kHz which bounces off the target, including submarines. This frequency is within the hearing range of common dolphins.

Acoustic signals from naval vessels have been strongly implicated in mass strandings of beaked whales. In ASW exercises, the vessels send loud pulses of sound into the ocean to listen for the echoes from other vessels or mines. Mid-frequency sonar is used to gather more definitive information when a target is at close range and higher shorter-range frequencies are used when a ship is hunting for mines, or when a survey vessel needs a high-resolution picture of the seabed. It has been postulated that sonar may lead to beaked whales making repeated, shallow dives to depths at which their lungs do not collapse, which may increase the risk of decompression-like sickness occurring (known in humans as "the bends"). These sounds are also believed to cause damage to cetaceans' ears, affect their feeding patterns and cause them to flee from the area and strand (Simmonds and Lopez-Jurado 1991, Frantzis 1998, Jepson et al 2003, Cox et al 2006). No such physical trauma was found in the common dolphins in this event (although the histopathology results for the dolphins' ears have yet to be revealed). The behaviour and lack of feeding prior to their stranding could, however, have been caused by such sounds.

The RN issued statements saying that the only sonar in use around the time of the mass stranding event was that being used by the seabed survey vessel HMS Enterprise. It was undertaking navigational training with a towed, low-power, high-frequency, short-range sonar transmission (2094D) at approximately 100 kHz and using routine, high frequencies echo sounders at 50 kHz, 30 nautical miles off the Plymouth Breakwater and at least 12 nautical miles off the coast (source: Times Online). The RN later reported the range was between 15 and 50 nm from the strandings event (source: RN, pers. comm). According to the RN, the vessel deployed side-scan and towed arrays between 1000 and1432 hours on 8th June in Falmouth Bay.

A large group of dolphins was seen 0.25 miles off Portscatho at 1430 hours on 8th June, heading south (source: CWT MSN). The possibility that these dolphins had been affected by the side scan sonar is quite plausible. However, their track was not reported subsequently so it is not possible to say whether these were the dolphins that later stranded. Also, the length of time between the use of the sonar and the stranding event suggests it is unlikely that this was the ultimate trigger that caused the mass stranding.

Other naval acoustic sources

A request under the Freedom of Information Act for Track/Events logs and Post Activity Analysis for all vessels in Falmouth Bay, for the period 1000 hours on Sunday 8th June to 1500 hours on Monday 9th June, was submitted in the hope that it might be possible to identify any other potential triggers to the mass stranding from the movements of other naval vessels, since only the logs for one vessel had been released by the MoD. This request was denied by the MoD on the grounds that "*the information is not centrally held and could only be provided by undertaking an unreasonable diversion of our resources and therefore falls within the exception at 12(4)(b) of the Environmental Information Regulations 2004.*" (source: Naval Service FOIA Cell). So it is not possible to say whether any other naval vessels were active and if so, in what way their operations may have had a bearing on the mass stranding.

Aircraft activity

Helicopters, including Merlins, using mid-frequency sonar dippers and sonobuoys, were deployed during the exercise up until Thursday 6th June and although Merlins were reported to still be flying, no helicopter or fixed wing aircraft activity, including any airborne low frequency sonars, was said by the RN to be taking place during the period of the mass stranding (source: Naval Service FOIA Cell). A request to the MoD for further information under the Freedom of Information Act was denied on the grounds that "*Further information is not held centrally and could only be provided by undertaking an unreasonable*

diversion of our resources and therefore falls with the exception at 12(4)(b) of the Environmental Information Regulations 2004."

The RN did disclose that a helicopter flying exercise (not involving ASW) took place between 0800-1330 on 9th June in the Falmouth, Falmouth Bay and Mounts Bay areas (no sonar of any type was deployed by the helicopters) and the Search and Rescue Sea King helicopter was operational that afternoon (source: Naval Service FOIA Cell). In a personal communication to the CSIP investigation, they stated that they were "now confident that there were no UK military aircraft movements over Falmouth until after the first report of the MSE" and that they "can also confirm that none of the other nations units exercising under FOST at that time conducted flying ops in the Falmouth Bay area in the period leading up to the MSE".

The next scheduled aircraft movements were reported to be on the morning of 9th June at 0858 when a Merlin launched for a short test flight, landing at 0931, and at 0937 and 0938 when a Lynx and two Mk 4 Sea King helicopters landed at RNAS Culdrose from Yeovilton. Shortly after, two Hawk jets were launched for just under an hour to participate in the morning Air Defence Exercise and another Merlin conducted a brief sortie at 0951. Other sorties, including helicopters from RNAS Yeovilton, operating with fleet replenishment ship RFA Fort Austin, continued in the afternoon (source: Naval Service FOIA Cell).

Underwater telephone

An underwater telephone (UWT) was in use on occasions during the exercise. This device is usually deployed from a helicopter and operates at 8 kHz. At this frequency, any dolphins in the vicinity would have been affected. Although the first request for more information under the FoI Act was sent by CWT shortly after the mass stranding, no data relating to the underwater telephone was initially provided. According to the SCEA schedule, the UWT could have been in use at any time from 0745 hours on Monday 9th June (source: Naval Service FOIA Cell). However, data later released to the CSIP investigation revealed that the UWT was only used in the Plymouth area and was not used until after the dolphins had first been discovered in Porth Creek (source: RN, pers comm).

Live firing/explosions

Local people reported hearing explosions in Falmouth Bay over the weekend of the mass stranding event and in the early hours of Monday 9th June. Residents on the Lizard were woken by a very loud sound of unexplained source. Resident 1 described it as "*a terrific bang, like a cannon ball being dropped from the ceiling onto a wooden floor*". She said it shook the room. Resident 2, living in Porthallow, said she was woken up around 0030 hours by "*an almighty boom*" or "*very deep thump*" which seemed to come from the direction of the sea. The RN stated that no naval exercises were scheduled to be conducting firings during this time and no naval training took place in the area to which the reported sounds could be attributed (source: Naval Service FOIA Cell).

A report in the media described an eye-witness account by an ex-artilleryman of a tracer shot or spent missile that was seen at 0020 hours descending west to east at a 45-degree angle into the water, although it carried no sound (source: This is Cornwall). This report could not be verified.

Live firing was also reported by the public on the Monday 9th, including live firing at 0745 heard above Porth Creek from the direction of Dodman Point. The MCA was quoted as saying there had been continual live firing up until Monday evening when the exercise was cancelled (source: Plymouth Herald). A MoD spokeswoman, however, stated that there was live firing up until midday Sunday 8th, but none between then and midday on Monday 9th. Munitions used in the exercise included live and inert ammunition and a Sea Wolf missile. (Source: Naval Service FOI Cell).

Naval flares were apparently in use, but the RN said that these were not being used to illuminate undersea targets, rather that they were used for safety, gunnery firing and non-firing exercises, signalling and for aviation (source: Naval Service FOI Cell).

Naval Mitigation measures

A spokesperson for the UK's Ministry of Defence said in a statement published in Nature (News, August 2008) that: "*Active sonar releases energy into the ocean, and there is evidence to suggest that this may have an effect on marine mammals. However, the precise scientific effects are not clear, thus the MoD has adopted a precautionary approach to mitigate effects on the marine environment. Environmental Impact Assessments are mandatory prior to the use of military sonar, and the ability to predict and detect marine life continues to be developed in order to minimise any perceived threats to marine life*."

The mitigation measures the RN has developed to limit the effect of naval sonar on cetaceans include having Marine Mammal Observers and sonar operators conduct both a visual and listening watch for 30 minutes prior to the start of any sonar activity, and 30 minutes after completion of the exercise. They record pre- and post-exercise marine mammal activity, using normal binoculars and stabilised gun direction sights, infra-red and thermal imaging, radar and passive acoustic monitoring (source: RN, pers comm). Sonar activity during the "Thursday War" is also supported by additional lookouts in the form of the upper deck weapons crews who remain in position throughout the exercise. All sightings are reported and communicated to other vessels involved in the exercise. Foreign navies working under the direction of the Royal Navy's Flag Officer Sea Training are briefed and expected to follow the same procedures (source: RN, pers comm).

Sonar emissions are ramped up gradually in intensity to allow marine mammals to move away before the sound becomes too loud.

Various environmental impact assessment forms and logs, including marine life report forms, environmental protection checklists, mitigation records and a Post Activity Analysis Form, must be completed for each ASW operation.

RN guidelines state that the Underwater Telephone, deployed from Merlin helicopters or from ships, is not to be used in identified sensitive sites such as areas of cetacean breeding or feeding and transmission should not begin until a minimum distance of 34 metres is achieved. But, most importantly, the guidelines say that the telephone "*should not be operated in situations where there is a risk that cetaceans may become trapped or embayed between the coast and the sonar as this may result in animals stranding*."

Overflying of animals at the sea surface should be avoided. A minimum flight height of 1640 ft (500 m) over observed animals should be maintained where practical and dead or injured marine mammals seen before, during or after operations should be recorded (source: Naval Service FOIA Cell).

When asked, under the FoIA, why the exercise was allowed to continue into Monday, following the mass stranding, when it was clear that dolphins were present in abundance in Falmouth Bay, the MoD responded by saying that "*Both Common and Bottlenose dolphins have been abundant in the South Western Approaches since records began. Active sonar operations did not commence until well after the stranding event had completed and were to the South West of Mounts Bay.*" (Source: Naval Service FOI Cell). While it may be accurate to say that sonar activity recommenced some distance away from the location of the mass stranding event in the afternoon, other activities, including helicopter deployment, continued much closer to the rescue operation, according to rescuers.

Discussion

As Jepson and Deaville (2009) concluded, none of the theories described above seems to offer a definitive cause or activity that triggered the mass stranding and the precise timing of the stranding event has not been established.

The link to the naval exercise, while not proven, seemed the most plausible explanation for the adverse behaviour of the dolphins and is the most likely trigger for the mass stranding event.

In recent years, mass stranding events have been linked to an increasing number of naval exercises in which sonar has been used, albeit in beaked whale species where the hypothesis for the cause-effect would not be relevant to dolphin species strandings. In addition, and more significant to this case, military sonar has been linked to marked changes in cetacean behaviour, including disruption of communication, panic and flight, displacement from habitat, affects on breeding and disruption to feeding patterns (source: IFAW, 2009). An unpublished report, produced for the MoD/UK's Defence Science and Technology Laboratory, into behavioural changes in cetaceans involved in mass stranding events linked to naval sonar, showed that low levels of sonar, which do not cause direct physical damage to whales, could still cause them harm by triggering behavioural changes, including disruption or cessation of feeding (source: Nature News, 2008). Possibly, the fact that the dolphins' stomachs were empty in this incident points to a similar cause.

All this is supposition in the absence of evidence about such factors as the time the dolphins arrived in Falmouth Bay, which direction they came from and their behaviour. Further information would be very welcome.

The RN confirmed that they provided all data relating to the use of sonar and that nothing had been withheld. However, it is possible that the trigger for the panic among the dolphins that led to their deaths was related to some other acoustic or perceived threat and not to sonar at all. The naval exercise covered a large area of dolphin habitat and until the afternoon of 9th June, intermittent acoustic outputs

from naval vessels were reported, including the use of standard echosounders (35/50/200 kHz), other sonars, acoustic modems, autonomous sonobuoys and the firing of live, inert and blank ammunition, including a single live Seawolf missile (Jepson and Deaville, 2009).

Current mitigation measures during military exercises are focussed on preventing auditory damage and little account is taken of other forms of physiological or socio-physiological effects that could lead cetaceans to strand. Any one of these other types of acoustic input or disturbance could have been sufficient to act as a 'curtain effect', pinning animals inshore and creating a panic reaction in a species that found itself in unfamiliar waters.

Helicopters have also been known to create an adverse reaction among groups of cetaceans, as was seen when rescuers were attempting to guide the dolphins out to sea. Cetacean behavioural responses to helicopters are greater if the aircraft are at low altitude (below 500m) and are greater for helicopters than fixed-wing aircraft for a given altitude. Cetacean responses to helicopters are also greater if the initial behavioural state is resting, if the cetaceans are in shallow water, if there are mothers with calves, or if the cetaceans are close to shore (Dr P Jepson, pers comm). Three of these criteria apply in this case.

A naval helicopter exercise was scheduled to take place between 0800-1330 hours in Falmouth Bay North, Falmouth Bay and Mounts Bay on the morning of June 9th. The RN reported that the first flights embarked at 0858 hours, after the mass stranding took place, but why there was a delay in commencement of operation is unknown. It is possible that helicopter activity over Falmouth Bay or estuary during the period could have been the stimulus for the second flight of the dolphins that entered Falmouth harbour. However, as detailed flight records were not available for the period, this could not be verified.

Live firing also continued during the rescue effort. Both these factors could have been sufficient to create a panic reaction among a group of dolphins already stressed from being embayed near the coast or finding themselves in unfamiliar inshore waters.

Although these exercises are said to be a frequent occurrence, it is possible that there is some unknown feature of this particular exercise which differed from those previously held. Certainly the presence of this species of dolphin so close inshore was in itself relatively unusual for the time of year, and it may be that they found themselves caught between the coast and the naval exercise and could not find a way out to the open sea. All this is conjecture, but what cannot be avoided is the fact that the naval exercise was the only significant event in the area at the time and included the use of sonar, sonobuoys, hydrophones, pyrotechnics, searchlights, radar, infra-red detection, mines, torpedoes and ammunition, as well as helicopter activity.

Conclusions

Having considered various theories about the potential cause or trigger of the mass stranding event, it was possible to eliminate the majority with confidence. In contrast, the naval exercise is the only known cause of high-intensity acoustic activities in the region of the mass stranding at that time and, having ruled-out other likely causes, is considered the most probable direct trigger of the event, although it is impossible to reach a definite conclusion on the basis of the information received to date.

Although many of the naval activities are routine and have occurred over many years in this region, a key factor may be the large group of common dolphins seen very close to shore in/near Falmouth Bay in the days leading up to the mass stranding. Naval activities in the week preceding the event may also have had a causal role in containing the normally pelagic dolphins closer to shore.

In most mass strandings related to Naval activity, anti-submarine warfare sonar is considered the most likely cause, at least for beaked whales. However, in this case, the sonar used by the navy was reported to have finished well before the dolphins came into Porth Creek. A submarine was still active in the Southern Exercise Area, including Falmouth Bay throughout June 8th (source: Naval Service FOI Cell) although it was not using ASW sonar and its purpose was not identified. Post-mortem examinations did not find any lesions, similar to those seen in beaked whales that have stranded during/after naval exercises, that are believed to occur as a result of disruption of surfacing/dive patterns (specifically, no gas bubble lesions were found) (Jepson et al 2003; Fernández et al 2005; Zimmer and Tyack 2007). Nevertheless, the earlier ASW exercise may have had a detrimental effect on the dolphins' behaviour, possibly disrupting their feeding and causing agitation. The post mortem’s conducted on the dead stranded animals showed them to have empty stomachs, which potentially indicates this disruption to feeding.

It is also possible that the second wave of panic, seen when the dolphins came into Falmouth harbour, may have been caused by naval helicopters which were flying at that time.

This stranding was a rare event and there is little research to show how common dolphins might react in such circumstances.

Ultimately, it may not be possible to attribute the mass stranding to a single cause. As is often the case in such events, a number of factors may have played a part. What is crucial is that every attempt is made to try to prevent another mass stranding, whatever the trigger may be.

Over the last 20 years, nearly 2000 cetaceans have been found dead on Cornish beaches. 480 have been subject to post-mortem examination and the majority (approximately 60%) have been shown to be the victims of accidental bycatch in fishing nets (source: Jepson, editor, 2005). While the death toll from the mass stranding represents only a fraction of that number, any additional threats to cetaceans in the southwest should not be taken lightly. Collectively, these human-induced activities affect not only common dolphins, but harbour porpoises and perhaps more critically, the dwindling population of inshore bottlenose dolphins around Cornwall.

The RN, in particular, has a regular and significant presence in the area and whether or not their activities contributed to the cause of this mass stranding, they still have the potential to cause harm by displacing dolphins from their habitat and causing cumulative detrimental effects by the use of sonar. Although much effort has been put into finding a solution to the problem of bycatch, progress has until recently been painfully slow. It can only be hoped that a similar approach is not taken towards the casualties of such mass stranding events. Consideration should be given to the cumulative effects of prolonged anthropogenic activities on marine mammals, which may not yet have become obvious. Ultimately they could lead to physical impairment or injury, reproductive failure, loss of habitat and a reduction in prey stocks.

Therefore, those at the forefront of cetacean conservation in Cornwall are keen to work with the RN and other local agencies to strengthen existing protocols and consider additional mitigation measures that might be implemented to make every possible effort to prevent the avoidable death and decline of cetaceans around Cornwall and the rest of the UK.

Recommendations

Cornwall Wildlife Trust Marine Strandings Network and British Divers Marine Life Rescue strongly feel that a co-operative approach to potential problems is the way forward and, as such, have proposed a number of recommendations to various services and agencies, which hopefully take into account the needs of the RN to conduct naval exercises in the national interest during peacetime and the desire of the media to report on notable events.

They include the suggestion that a working group of representatives from BDMLR, CWT MSN, RN, HM Coastguard and other stakeholders be formed to exchange information and expertise concerning marine wildlife and to discuss potential mitigation and response measures that are pertinent to areas in the southwest where anthropogenic activities conflict with marine mammals and other species. Greater support for research into marine mammal behaviour, populations and distribution is also required, to better identify possible causes of cetacean mass strandings.

Meanwhile, we strongly recommend that the precautionary principle be applied by all marine users and the media, should such a situation arise again. This would help to prevent further distress among stranded or disorientated animals and ensure that cetaceans are clear of naval operational areas and other events before activity recommences.

Acknowledgements

This report examines the facts and theories around the mass stranding of the dolphins. What it is not able to do is describe the deep feelings experienced by all those who took part in the event. Nor is it able to do justice to their dedication and determination to save the lives of the remaining dolphins and find the cause of death of those that did not survive.

Production of this report was possible, mainly thanks to Lesley Jarvis (BDMLR) and Debs Wallis (CWT MSN), who contributed a vast amount of information about the position and behaviour of the dolphins in various locations, and to various agencies and members of the public who were involved.

Data on the RN exercise were provided by Lt Cdr RN Lez Hardy, Cdr Andy Robinson and the Naval Service FOI Cell under the Freedom of Information Act 2000 and by personal communication with the CSIP investigation.

All post-mortem investigations were carried out under the CSIP, which is funded by Defra and the devolved administrations. The investigation into the mass stranding event, conducted by the CSIP, was fully funded by Defra through a variation to the existing contract.

Numerous other people assisted on that day, many of whom remain unknown. We would sincerely like to thank them all, as well as the following:

- Conrad Birnie and Seth Neill, groundsmen at Froe, Porth Creek who reported the stranding and assisted with this report.
- BDMLR Marine Mammal Medics and vets for their dedicated work and skilled teamwork throughout the day.
- Cornwall Wildlife Trust Marine Strandings Network volunteers and their friends, who assisted with the rescue and the retrieval of the dead dolphins and transported them for post-mortem examination.
- RNLI Falmouth, who rescued dolphins and assisted unstintingly throughout the day.
- Caring members of the public at Gillan, who rescued stranded dolphins and assisted with this report.
- Members of the public who assisted with the rescue at Porth Creek, Place and Falmouth harbour.
- Cathedral Builders, who rescued a stranded dolphin at Place and assisted with this report.
- National Trust wardens who assisted with retrieving the dead dolphins, for their hard work and great coordination.
- MCA Portscatho.
- MCA HQ Falmouth for assistance with the rescue attempt in Falmouth harbour.
- Cornwall County Fire Service.
- Harbourmasters at St Mawes, Truro and Falmouth.
- Vic Simpson, Wildlife Veterinary Investigation Centre, for conducting post-mortem examinations.
- Colleagues at the Veterinary Laboratories Agency, Truro for conducting post-mortem examinations.
- Colleagues at the Institute of Zoology and Marine Environmental Monitoring for conducting post-mortem examinations and producing the CSIP report.
- National Seal Sanctuary staff, who also assisted with the rescue.
- RSPCA.
- King Harry Ferry staff.
- Falmouth Marine School students.
- Ray Dennis, CWT Sighting Database Coordinator for his help with cetacean sightings records.
- All the boat owners who provided transport for personnel and equipment around the rivers and helped with guiding animals to safe locations.
- The media for bringing the event to the attention of the public across the world.

References

Animal Welfare Institute. Animals in the Oceans.
http://www.awionline.org/ht/d/Items/cat_id/705/cids/705/pid/723

Barnett, J., Davison, N., Deaville, R., Monies, R., Loveridge, J.E., Tregenza, N., Jepson, P. Post mortem evidence for bottlenose dolphin (Tursiops truncatus) interactions with other dolphin species in southwest England (accepted for publication by the Veterinary Record).

Cox, T.M. et al. Understanding the Impacts of Anthropogenic Sound on Beaked Whales. J. Cet. Res. and Man. 7, 177-187 (2006).

Dolman, Sarah J. and Weir, Caroline R. Avoidance as a marine mammal conservation strategy: spatio-temporal management of anthropogenic sound.

Fernández, A. et al. Gas and Fat Embolic Syndrome Involving a Mass Stranding of Beaked Whales. (Family Ziphiidae) Exposed to Anthropogenic Sonar Signals Vet. Path. 42, 446-457 (2005).

Frantzis, A. Does acoustic testing strand whales? Nature 392, 29 (1998).

IFAW, 2009. The Dangers of High Intensity Military Sonar. http://www.ifaw.org/ifaw_germany/join_campaigns/protecting_whales_around_the_world/protect_whales_from_harmful_ocean_noise/the_dangers_of_high_intensity_military_sonar/index.php

Jepson, P.D. (editor) (2005) Cetacean Strandings Investigation and Co-ordination in the UK 2000-2004 (PDF). Final report to the Department for Environment, Food and Rural Affairs. Pp 1-79. http://randd.defra.gov.uk/Document.aspx?Document=WP01011_7735_ANN.pdf

Jepson, P.D. and Deaville. R. (2009). Investigation of the common dolphin mass stranding event in Cornwall, 9th June 2008. Final report to the Department for Environment, Food and Rural Affairs. 30pp. http://randd.defra.gov.uk/Document.aspx?Document=WC0601_8031_TRP.pdf

Jepson, P.D. et al. Gas-bubble lesions in stranded cetaceans. Nature, 425, 575-576 (2003).

Ministry of Defence. Freedom of Information. www.mod.uk/DefenceInternet/FreedomOfInformation/DisclosureLog/SearchDisclosureLog/NavalActivityPriorToDolphinStrandings3.htm

Mooney, T. Aran, Nachtigall, Paul E. and Vlachos, Stephanie. Sonar-induced temporary hearing loss in dolphins. Biology Letters, published online before print April 8, 2009, doi:10.1098/rsbl.2009.0099.

Nature (News) August 1st 2008. Sonar does affect whales, military report confirms.

Nevala, AE. The Sound of Sonar and the Fury about Whale Strandings, 2008. http://www.whoi.edu/oceanus/viewArticle.do?id=37146.

Parsons, E.C.M., Dolman, Sarah J., Wright, Andrew J., Rose, Naomi A. and Burns, W.C.G. 2008. Navy sonar and cetaceans: Just how much does the gun need to smoke before we act?

Plymouth Herald Friday 13th June 2008.

Royal Navy. HMS Enterprise Nav. Track/Events, 08 Jun 2008.

Simmonds, M. P. and Lopez-Jurado, L. F. Whales and the Military. Nature 51, 448 (1991).

This is Cornwall, June 18th 2009. http://www.thisiscornwall.co.uk/news/Readers-Readers-incidents/article-192131-detail/article.html

Times Online. http://women.timesonline.co.uk/tol/life_and_style/women/the_way_we_live/article4114945.ece

Zimmer, Walter M. X., Tyack, Peter L. Repetitive shallow dives pose decompression risk in deep-diving beaked whales. (2007) Marine Mammal Science Volume 23, 888-925.

Contacts

Cornwall Wildlife Trust Marine Strandings Network

Strandings Hotline: 0845 201 2626

Web site: http://www.cwtstrandings.org/

British Divers Marine Life Rescue

Tel: 01825 765 546

Web site: http://www.bdmlr.org.uk/