

A Review of a Norwegian Whale Hunt

J. Lonsdale, L. Garcés, A. Butterworth, C. Bass, C Perry

(Submitted by the Government of the UK)

1. Introduction

1.1 On 18th May 2005, a hunt of a minke whale was filmed in Norwegian coastal waters, near the island of Vardø off the north eastern tip of Norway. The film records the minke whale hunt from the beginning of the chase to the hauling of the whale on to the vessel. This paper reports and analyses the sequence of events during the hunt, providing a detailed account and description of the events in the film. Since the hunt was filmed without the knowledge of the crew of the vessel, it can be reasonably assumed that at no time did the cameras influence the activities aboard the vessel.

1.2 This analysis is believed by the authors to be the first of its kind to be produced in relation to a commercial whale hunt, and provides valuable data for the evaluation of whale killing methods. The authors acknowledge that this is film of only one hunt and that times to death (TTD) vary from one hunt to another. The authors would not claim that the hunt was 'typical' of hunts undertaken by Norwegian whaling vessels. However, since the data on TTD is within the range of TTD data reported by Norway, they believe that the incidents recorded in the film (and their implications for the welfare of hunted whales) are sufficiently representative of the whole as to be worthy of analysis.

During the meeting of the Whale Killing Methods and Associated Welfare Issues Working Group of the International Whaling Commission (IWC), held in Korea in June 2005, Norway indicated that the hunters that were filmed did not follow standard procedures in that they did not haul the whale to the boat immediately after it was shot¹.

1.3 This analysis allows for a unique detailed record of hunting in adverse conditions and demonstrates the changes (that can occur in fractions of a second) to the relative positions of the harpooner and the whale, which may impact on the position of the harpoon strike in the body of the whale and the subsequent time to death.

1.4 The Government of Norway has announced that, due to a lack of funding, only random inspection of vessels is planned for the near future, and that consequently no further research is to be carried out on whale killing methods used in the Norwegian minke whale hunt for the time being². Human observers are being replaced by 'Blue Boxes' - electronic logging systems - on vessels to collect basic information (e.g. time of harpoon release, time of hauling whale aboard the vessel)³. However, this new system does not record several key variables known to affect TTD (i.e. weather and sea conditions, strike position of the harpoon, use and number of deployments of secondary killing methods, the number of rifle shots fired and the impact on the whale, the time taken for the whale to die or the last visible sign of life of the whale), and therefore data on these variables is of significant interest to the IWC when collected by independent observers.

2. Results

2.1 Overview

A complete sequence of events of a whale hunt is captured on video film including:

- The pursuit
- The harpooning
- The use of the rifle as a secondary killing method
- The movement of the whale once it had been harpooned
- The timing of the last sighting of the whale when showing signs of vitality
- The hauling of the whale aboard the vessel
- The entry point of the harpoon into the whale

The film also shows:

- The sea and weather conditions
- The movements of the whaling vessel with some of the activities of the crew aboard the vessel

Table 1 shows a chronological summary of the real time sequence of the Norwegian whale kill recorded on 18th May 2005. A full chronology of the hunt is listed in **Appendix 1**. The distance from activity and material and equipment used is set out in **Appendix 2**. The position of the whale relative to the vessel, which also changes its heading throughout the sequence, is set out in **Appendix 1**.

A counter is shown on the DVD of the hunt, recording actual hours, minutes, seconds and 25th/sec commencing 0.08 second before the first sight of the blast from the harpoon gun and runs for 14 minutes 54 seconds. Reference to the counter in this paper is shown in italics (*00:00:00.00*).

Table 1. Real time sequence of Norwegian whale kill 18th May 2005

Time (Norway)	Activity	Whale movements elapsed time post harpooning T+(mins/secs)	Rifle shot elapsed time post harpooning T+(mins/secs)
06:50:00	Vessel leaves harbour		
09:48:03	Whale spotted		
11:10:47	Whale blows		
11:10:47	Whale struck (T)		
11:14:00	Whale blows, fin visible	03.34	
11:18:59	Whale blows port bow, swims sternward.	08.11	
11:21:48	Whale surfaces approx 30m from vessel's bow. Rifle shot 1	10.57	11.01
11:22:00	Whale blow and splash	11.07	
11:22:02	Rifle shot 2		11.09
11:22:07	Whale splash, blow	11.16	
11:22:16	Whale blow, rifle shot 3	11.25	11.25
11:22:31	Rifle shot 4		11.40
11:23:12	Whale blows off stern portside, rifle shot 5	12.21	12.21
11:23:57	Whale blow approx 12m off starboard bow. Rifle shot 6	13.06	13.06
11:24:06	Whale splash	13.15	
11:24:37	Whale surface, splash	13.46	
11:24:42	Weak blow	13.51	
11:24:54	Clear blow	14.03	
11:25:03	Whale splash	14.12	
11:25:04	Rifle shot 7		14.15
11:25:11	Whale surfaces	14.20	
11:25:14	Whale tail splash	14.23	
11:25:19	Large whale splash. Final movement.	14.28	
11:49:08	Whale clearly on bow.		

3. Environmental Conditions, Killing Method and Time to Death

3.1 Environmental conditions

The wind speed was 15-20 knots in a south south westerly to south westerly direction (SSW – SW), resulting in a sea state of moderate waves of a height of 1–2m with many whitecaps and some spray. The motion of the vessel in the waves was considerable, with the variation in the rise and fall of the bow erratic and estimated at times to be approximately 2 metres. Visibility was good, with no precipitation during the hunt.

3.2 Method of killing and time to death (TTD)

The film and photographic evidence indicates that the harpoon entered the abdomen on one side of the animal at a level just behind the pectoral fin and exited the animal on the opposite side at approximately the same level. A time of 14 minutes and 30 seconds was recorded from the moment when the whale was struck by the harpoon to the last visible movement of the animal, and this is taken as the estimated TTD.



During the 14 minute 30 second period, 7 rifle shots were fired at the whale from a range of distances of between approximately 7 - 30 metres. The first rifle shot occurred 11 minutes post-harpooning. Some rifle shots struck the water before hitting the whale.

Rifles used in the Norwegian minke whale hunt have full metal jacket round nosed ammunition and a minimum calibre of 9,3mm. The harpoon gunners are required to have passed obligatory annual shooting tests, both with rifles and harpoon guns².

4. Analysis

The filming of this hunt by independent observers allows for an original breakdown and analysis of a whale hunt. The persons on board the vessel were unaware that they were observed, and it can be reasonably assumed that the filming did not influence the conduct of the hunt.

4.1 Time to Death

The observed elapsed time from impact of the harpoon to apparent time of death (which is taken as the last time the whale is observed moving) is 14 minutes 30 seconds.

4.2 Position of harpoon impact and effects on the animal

The harpoon weighs about 15kg, and from film analysis appeared to be travelling at about 75ms^{-1} .⁴ This projectile is capable of passing entirely through the body of the animal from the point of impact, and the detonation of the grenade potentially adds further destructive energy to the missile's trajectory within the animal⁵. However, in this documented case, it is clear that the combined destructive energy of the harpoon and the grenade were not sufficient to bring about a rapid death.

It is unclear from the film evidence whether or not the harpoon's grenade detonated reliably within the whale. From the time that the harpoon was fired to the last visible sign of life, the whale was tethered to the vessel by the arms of an expanded harpoon head, the body of the harpoon itself and a line, all of which penetrated the abdomen. Despite this, the whale appeared to be actively moving around the vessel and surfacing to breathe, and was seen on both the starboard and port sides of the vessel.

4.3 Accuracy of the harpoon aim

The harpoon was fired from the starboard side of the bow. Viewing the film frame by frame shows that the first discharge smoke from the firing of the harpoon was seen 1.08 seconds after the first sight of the whale's blow. As the first sight of the blast from the cannon was seen, the bow of the vessel was just beginning to fall.

The first splash of the harpoon grenade was seen in the sea 1.44 seconds after and approximately where the blow of the whale was seen.

During this period the bow of the vessel moved a significant extent, and it may be inferred that the rise and fall during the aiming time and during the transit of the harpoon may have compromised the accuracy of the harpoon shot and therefore the positioning of the harpoon strike in the body of the whale.

4.4 Effect of secondary killing method

The use of the rifle as a secondary killing method appears to have been ineffective in this documented case. Seven rifle shots were observed, fired up to a distance of approximately 30m from the animal. The first shot was fired 11 minutes 1.76 seconds (00:11:01:11) and the last shot recorded 14 minutes 15 seconds (00:14:15.23) after the firing of the harpoon gun. Several bullets hit the water, thus probably being both deflected from their original trajectories and slowed down. The vessel was observed to heave in the waves during the time the rifle was being used. The ability of the rifleman to fire an accurate shot may have been impaired by the distance of the whale from the vessel and the movement of the vessel and the whale in the aforementioned sea conditions.

4.5 Additional factors contributing to extended TTD

The harpoon is attached to the bow by a heavy hauling line that tethers the whale to the vessel once the harpoon is embedded in the body of the whale. The line is wound on a heavy-duty winch drum capable of hauling a live whale to the bow of the vessel. The observation made from the film material suggests that the crew had encountered problems with hauling the whale quickly to the side of the vessel.

5. Discussion

5.1 Factors leading to non-occurrence of instantaneous death

Neither instantaneous death nor insensibility was achieved by the firing of the harpoon in this hunt. The harpoon struck the animal in the abdomen, and therefore required the use of a secondary killing method in order to try to prevent prolonged suffering. The use of the rifle, as described, is only effective when undertaken in close proximity to the target⁶. The authors assume that the harpoon had a tenuous hold within the whale's abdomen, which might have led the crew to decide not to pull the whale quickly to the side of the vessel, lest it break loose and thus be lost. Rifle shots were fired at a distance of up to 30m with the whale's head fully or partially submerged and were consequently ineffective.

5.2 Shot accuracy and the effects of environmental factors

Given that the harpooner must shoot the harpoon at the moment the whale is seen to surface, any fraction of hesitation or any instability in the sea or platform from which the harpooner is aiming compromises the ability of the harpooner to deliver the ideal shot to the upper thorax, approximately one metre from the brain⁶. Øen (2005) states that the Norwegian Minke whale hunt is dependent on calm sea and little wind and that in windy weather boats usually stay in port³. The sea conditions of this hunt presented particular challenges for shot accuracy and may be considered as a key challenge to all hunts. Lack of ideal conditions will compromise accuracy of both the harpoon and the rifle shots. This analysis allows for a unique detailed record of the results of hunting in adverse conditions and demonstrates the changes that occur in fractions of a second to the relative positions of the harpooner and the whale. The conditions with respect to wind speed, wave height and visibility are considered by the authors to be poor in this hunt.

5.3 The rifle as a secondary killing method

According to Øen and Knudsen (2003), the rifle is usually fired from close range and when the whale's head is above the water and the hunter is supposed to aim at the brain⁶. Øen and Knudsen state that as long as the whale is submerged the shot cannot be aimed at the vital organs in the thorax, and that water has a considerable braking effect on a light projectile with high speed. Trials by Øen in 1995 demonstrated that a rifle bullet would, following passage through water, hardly penetrate the blubber and definitely not kill a whale rapidly. The whale's head must be above the water and the shot directed at the central nervous system, penetrating the thorax and hitting a main blood vessel such as the aorta⁶. Øen and Knudsen state that bullets will decelerate and change trajectory when passing through water.

In the hunt under examination seven rifle shots were fired in an effort to kill the whale. The film shows that none of the shots was fired at close range. Several of these shots, it is observed, travelled through the water before hitting the whale. These findings raise issues as to the reliability of the rifle as a secondary killing method - its efficacy being critically dependent on the whale being tethered to the side of the vessel with its head above the water.

5.4 Trauma resulting from killing methods

As well as direct physical damage from the harpoon grenade and bullets, the animal in this case will have experienced the effects of blood loss and the entrance of seawater into the body cavity. Moreover, the harpoon line could be seen to tighten and slacken with the wave peaks and troughs, causing further internal trauma to the animal. The whale was observed to make at least 16 discrete signs of life post-harpooning.

5.5 Implications of findings for the 'Blue Box' system

The vessel is known to have had a Blue Box installed but did not have a national inspector on board ⁷.

Were this to become the norm, as the authors of this paper believe to be the case, the result would be that important details regarding the welfare of whales during Norway's hunts would not be recorded in future. The authors suggest that the data recorded by independent observers which is unrecorded by the 'Blue Box' is vital to that type of analysis which will be of particular use in identifying aspects of whale hunting that present key challenges for improving the welfare of hunted whales.

6. Conclusions

It would appear that the extended time to death in this documented case was a result of two key factors:

- 1) The striking of the harpoon in the lower abdomen did not result in sufficient trauma to induce immediate loss of consciousness and death.
- 2) The consequent inability of the crew (without risk of losing the whale) to draw the animal to the side of the vessel in order to achieve an accurate aim for use of a secondary killing method.

A series of independent and inter-dependent external factors was observed to contribute to the extended time to death of the whale in this analysis:

- The weather and sea conditions;
- The unpredictable movement of the vessel in a turbulent sea;
- The unpredictable movement of the whale both before and after it is struck by the harpoon, particularly in a turbulent sea;
- The position in which the harpoon struck the lower abdomen of the whale;
- The fact that the whale was not drawn quickly to the side of the vessel;
- The shooting of the whale from a distance with the whale at least partially submerged;

This analysis demonstrates the ease with which one circumstance (i.e. the failure to kill the whale with an instantaneous shot to the thorax) can result in a situation where the hunters and vessel skipper have little or no control over the welfare of the targeted animal and are unable to impose immediate loss of consciousness and death.

This analysis identifies a series of issues that present key challenges for achieving immediate loss of consciousness and death in hunted whales. The paper also provides an insight into the information that can be collected by independent observers beyond the Blue Box's capabilities. The value of comprehensive human-recorded data on whale hunts to the IWC is clear. It allows critical examination of the consequences of hunts in 'less-than-optimal' conditions – as described in this paper - and provides material for constructive debate on how best to avoid these situations. The lack of verification by national inspectors means that details on the welfare of whales during hunts may remain unrecorded in future. This study makes a strong case for the necessity of a human observer to record details related to the welfare of whales, which cannot be captured in blue box records.

The sea conditions in this hunt presented particular challenges and may be considered as a key challenge to all hunts. Lack of ideal conditions can compromise accuracy of both the harpoon and the rifle shots. This study presents a unique detailed record of the results of hunting in adverse weather conditions and demonstrates a need to define acceptable limit weather conditions for whale hunts.

Appendix 1. Activity details for real time sequence for Norwegian whale kill 18th May 2005

The times shown in **bold** are real local time. The counter shown in ***italic bold*** was started 02/25 second before the first sight of the blast from the harpoon gun.

The Pursuit	
06:50	<i>Willassen Senior</i> leaves the port of Vardø and observation of activities on board suggests that the search for a whale begins immediately. The wind is blowing at about 15-20 knots and the sea conditions are choppy with whitecaps and swells of around 1-1.5 metres. There is light cloud and clear conditions.
09:44	The vessel is located just north of the village of Ytre Kiberg and estimated to be about 300-500 metres from the shore. The vessel rises and falls in the waves with a variance of about 2 metres.
09:53	The activities of the crew of the <i>Willassen Senior</i> suggest that a whale has been spotted. The vessel has stopped and it is assumed that the crew are searching for the whale to resurface.
09:59	The vessel travels south-southwest. The wind is blowing parallel to the shoreline and the vessel is heaving considerably.
10:05	The vessel has stopped. Two men are in the crow's nest and one man is positioned at the harpoon gun.
10:09	There are indications that the crew have spotted a whale again. The vessel accelerates forward, having changed direction. It is now facing perpendicular to the shore, maintaining its position. Observations suggest that the crew are again waiting for the whale to resurface.
10:13	The vessel alters course and travels slowly south.
10:16	The vessel has stopped. Crew can be seen on the bow of the vessel searching for the whale.
10:17	A small fishing vessel travelling from Ytre Kiberg passes close by the whaler.
10:20	The <i>Willassen Senior</i> travels south again at approximately 3 knots. There are indications that the crew have spotted the whale in a southerly direction relative to the vessel.
10:21	The vessel slows down and the crew can be seen aboard the vessel searching for the whale.
10:22	The vessel changes direction and travels towards the shore again.
10:23	The vessel stops and the crew continue to search for the whale. The bow of the vessel is rising by about 2 metres as the boat heaves in the swell.
10:27	The vessel changes direction and travels in a northerly direction, parallel to the coastline. Observers remain in the crow's nest.
10:30	The vessel is stationary, facing out to sea. Observations suggest that the crew believe there is a whale nearby and continue their search.
10:32	The vessel travels in a northerly direction.
10:33	The vessel is reversed.
10:34	The harpoon gunner is aiming the harpoon gun down the starboard side of the bow.
10:37	The vessel increases its speed as it moves slowly towards the shore.
10:38	The vessel changes direction, decelerates and is travelling north. It is heaving considerably with some waves rising to the bow deck. The erratic waves result in erratic movement of the boat.
10:40	The vessel travels slowly north at about 1-2 knots. Two people are seen in the crow's nest searching for the whale
10:42:27	The vessel accelerates north. Observations suggest that a whale has been spotted further away.
10:43:09	<i>The vessel moves out view of the observers who move to a new position.</i>
11:01	<i>GPS position of the observers is North 70 degrees, 16.925 East 31 degrees, 01.822 Elevation, 110 feet. The camera is placed on a tripod</i>

Preparation For Harpooning	
11:03	The observers have sight of the <i>Willassen Senior</i> as it appears from the headland, travelling slowly south. Waves are causing the vessel to rise and fall. As the bow rises waves can be seen washing over the starboard stern deck. As the bow falls waves rise up the bow and can be seen washing over the edge of the starboard bow deck almost covering the entire side of the starboard bow with heavy spray
11:06	<i>Willassen Senior</i> continues to travel slowly south.
11:09	<i>Willassen Senior</i> is accelerating towards the shore. Observations suggest that it is in pursuit of a whale. A member of the crew positions himself at the harpoon gun. Two members of the crew are in the crow's nest. A third climbs up to the crow's nest. The vessel alters direction to starboard, and is now travelling in an approximate south westerly direction
11:09:51	A crewmember in the crow's nest points ahead, indicating he has seen a whale. The harpoon gunner is at the harpoon gun. The harpoon gunner is pointing up and then down with his hands. It appears that he is signalling that the whale has surfaced and then dived.
11:10:39	The harpoon gunner appears to be sighting the harpoon gun. A crewmember in the crow's nest is pointing ahead. The vessel turns gradually to port and is travelling approximately southwest.
11:10:47	The Harpoon is Fired and Strikes the Whale.

Harpooning and Time to Death	
<i>A counter is shown on the DVD, recording actual hours, minutes, seconds and 25th/sec (00:00:00:00).</i>	
11:10:47	The whale's blow is seen, estimated to be 30-35 metres away from the vessel off the starboard side. As the blow is seen the bow of the vessel is rising out of the sea.
11:10:47 00:00:00:02	The harpoon is fired from the starboard side of the bow. The first discharge smoke from the tip of the cannon is seen 1.08 seconds after the first sight of the whale's blow. As the first sight of the blast from the cannon is seen, the bow of the vessel is beginning to fall.
00:00:00:13	The first splash of the harpoon grenade is seen in the sea 1.44 seconds after and approximately where the blow of the whale was seen.
00:00:00:16	The strongest rise of the spray occurs 0.56 second after the firing of the cannon.
00:00:00:24	The greatest rise of the spray occurs 0.88 seconds after the firing and is dispersing. 1.28 seconds after the firing there is no sight of the spray.
	Three seconds after firing, the harpoon gunner moves to the starboard side of the bow.
	From these timings and an estimation of the distance travelled by the harpoon, the speed of the harpoon is calculated to be 75ms⁻¹.
11:10:51	The observers hear the sound of the harpoon shot. 9 seconds after the firing of the harpoon a crewmember descends from the crow's nest. 25 seconds after the firing of the harpoon a second crewmember descends from the crows nest leaving one crewmember remaining in the crows nest. The harpoon gunner is moving about the bow deck. The vessel is almost stationary, facing approximately south and rocking in the waves. The vessel slightly swings to port and then to starboard. 1 minute 17 seconds after the firing of the harpoon a crewmember can be seen climbing onto the roof of the bridge. Other activity can be seen on the port deck. 3 minutes after the harpoon has been fired the gunner can be seen on the bow and may be reloading the harpoon gun.
11:14 00:03:34:08	The whale is observed, having swum around to the port bow of the vessel. It blows and breaks the surface of the sea with the dorsal fin clearly visible about 30 metres from the port stern of the vessel. The bow of the vessel is pointing in a south westerly direction.
11:15:04	The vessel has stopped and is reversed a short distance.
00:04:30:20	A crewmember walks around the bow and then moves to the port side of the bow.
00:04:30:20	A crewmember runs along the port side deck and enters the wheelhouse.
00:05:13	This crewmember leaves the wheelhouse, walks to the bow and stands by the harpoon gun.
00:05:47:04	A second crewmember can be seen emerging from the starboard side of the bow. Vessel turns slowly to port
11:16	The line from the harpoon is taut on the bow of the vessel indicating that it has struck and is embedded in the whale. The vessel is rising and falling in the waves and swell and the bow is moving to port.
00:06:17:16	The vessel has swung round to port and the bow is pointing in a southeasterly direction
11:17:16	<i>A GPS reading is recorded on the film and the tape ends and is changed.</i>
11:18:01	<i>A second GPS reading is recorded on the film as the new tape begins recording. GPS readings indicate that 45 seconds elapse with the change of tape.</i>
00:07:17:00	The vessel is facing north and directly towards the observers and the line attached to the harpoon can be seen leading off the starboard bow.
00:07:35:00	The vessel is moving gradually to port. Three members of the crew can be seen on the bow of the vessel. As the bow of the vessel falls in the waves, the line attached to the harpoon slackens. As the bow rises, it becomes taut.
00:07:48:13- 00:08:09:18	A small vessel passing <i>Willassen Senior</i> can be seen on the film.
11:18:59 00:08:11:15	The whale is observed off the port side of the bow of the vessel. It is observed to be alive as it blows, its back breaks the surface and its fin is clearly visible. It is swimming towards the stern, parallel to the vessel. A crewmember on the bow signals to the captain to back up the vessel.
11:19:15 00:08:20	A crewmember is waving and his behaviour suggests that there is a possibility that the harpoon line could become entangled in the propeller. A member of the crew is still in the crow's nest.
00:08:33	A crewmember moves from the bow and retrieves something from the base of the mast. He positions himself again on the port side of the bow. The vessel is heaving considerably in the waves as it moves gradually to starboard, facing perpendicular to the shore.
00:10:10:00	The vessel has moved further in a starboard direction and is now horizontal to the shore. Three members of the crew are leaning over the bow.
11:21:48 00:11:00:13	The whale blows and is observed surfacing again about 30 metres off the vessel's bow.
00:11:01:00	The blow reaches its peak in 0.48 second and subsides 0.36 second later
00:11:01:11	Approximately 0.92 second after the blow is first seen, a splash from a rifle shot is seen and can be heard on the video tape approximately 2 seconds later. The rifle bullet forms a spray about a metre from where the whale's blow can be seen, between the blow and the vessel. Observations show that the rifle shot may have been aimed at below the blowhole region of the whale's body. It may have hit the whale in the back or may have missed it.
11:22:00 00:11:11:13	The whale just begins to break the surface and a blow and splashing can be seen. The whale appears to be struggling as the vessel moves slowly in reverse.
00:11:12:09	A splash from a second shot can be seen and heard on the tape approximately 2 seconds later.
00:11:12:17	The splash subsides. The whale can be clearly seen to be making co-ordinated swimming efforts.
11:22:16 00:11:27:21	A blow from the whale can be seen.
00:11:28:21	A splash from a third rifle shot hits the water and can be heard on the tape approximately 2 seconds later.

11:22:31 00:11:43:05	The splash from a fourth rifle shot is seen and can be heard on the video tape approximately 2 seconds later.
11:22:48	The vessel is seen to be moving in reverse and the bow is pointing in a north easterly direction towards the shore.
11:23:12 00:12:24:19	Two men are on the bow of the vessel and one man on the stern. The whale has swum to the port side of the stern.
00:12:29:22.	The spray from its blow may also include spray from the fifth rifle shot as a shot can be heard on the tape.
11:23:27	The vessel continues to rise and fall considerably in the waves as it moves slowly in reverse.
11:23:57 00:13:08:15	The whale has again moved to the starboard side of the vessel, approximately 12 metres off the starboard bow. Another blow from the whale can be seen.
00:13:09:00	The spray from the blow subsides.
00:13:09:13	The splash from a sixth rifle shot can be first seen in approximately the same place as the blow was seen and is heard on the tape approximately 2 seconds later.
00:13:09:19	The spray subsides. The bow of the vessel is facing towards the shore. The vessel continues to move in reverse as the crew draws the whale slowly to the vessel. The bow of the vessel is gradually turning to starboard.
00:13:40:19	A blow or possibly a splash from the whale is seen.
00:13:42:09	A larger splash is seen.
00:13:43:11	Further splashing by the whale.
00:13:52:17	The whale splashes, followed by a larger splash
00:14:05:24	A splash begins to rise from the water.
00:14:06:06	The splash reaches its peak.
00:14:09:18	Splashes from the whale can be seen.
00:14:15:23	The spray from the seventh rifle shot rises strongly and vertically into the air.
00:14:16:13	The spray subsides from the shot.
00:14:21:12	What appears to be a pectoral fin can be seen rising from the water. This is followed by splashing for 1.48 seconds.
00:14:22:24	The splash subsides
00:14:26:05	The whale's flukes rise above the sea surface.
00:14:26:17	The tail is slapped on to the sea surface.
00:14:29:23	Again the whale is making co-ordinated active movement with visible splashing.
00:14:31:08	The splashing subsides. This is the final time that the whale is seen by the observers before it is brought aboard the vessel
<i>The minimum Time to Death is 14 minutes and 30 seconds based on observation of vital movement from the animal. However, the actual time to death may be significantly longer, as it was not possible to observe the animal in the last 23 minutes and 29 seconds, the time between last vital movements of the whale and bringing it aboard the vessel. (See Table 1. for sequence)</i>	

Movement of the Vessel after the last sighting of movement by the whale	
11:25:31	The vessel continues to move slowly in reverse.
11:26:38	The vessel is reversing at about 2 knots and is heaving in the swell and waves.
11:30:24	The bow is now facing perpendicular to the shore.
11:30:54	The vessel appears to be moving forwards
11:31:58	The vessel travels forward and the line to the whale is taut at an angle of about 45 degrees from the bow.
11:32:51	The vessel stops.
11:33:24	The line is now taut and perpendicular to the bow. The vessel is heaving considerably.
11:39:36	The vessel turns, continuing to heave and the stern is now perpendicular to the shore.
11:41:31	The whale is visible off the port side of the vessel. Members of the crew appear to be securing lines around the tail.
11: 42:26	The vessel is virtually stationary.
11:43:15	The whale is off the bow in the water.
11:43:48	The vessel is facing perpendicular to the shore.
11:44:09	The whale is immediately in front of the bow of the vessel.
11:45:30	The whale is being winched up the side of the vessel using a derrick.
11:48:40	The whale is finally lifted onto the deck of the vessel. The harpoon can be seen embedded on the right hand side of the underside of the whale below the pectoral fin. The harpoon has entered one side of the lower abdomen and exited the other although it is not possible to say categorically which is the entry and which is the exit wound. Intestines of the whale appear to be emerging from the wound.

Appendix 2: Distance from activity and Materials and Methods Used

Distance from activity

The hunt was filmed from the shore with the vessel operating about 300-400 metres from the shore.

Materials and methods

Equipment

A Sony FX1 High Definition HDR 1080i-DV camera was used to film the hunt and record sound. The camera adopts the HDV 1080i specification, which utilises 1080 effective scanning lines, within the HDV standards and records pictures at the images bit rate of about 25 Mbps. This technology enables broadcast quality images from a domestic styled camera. The camera has a Carl Zeiss lens with a focal length equivalent to a 32 mm – 390 mm lens in the 35 mm stills format.

The photographic stills were shot on a Nikon FM 35 mm camera with lenses ranging from 28 mm to 600 mm. Fujichrome Sencia film at both 100 ASA and 400 ASA was used. A Garmin emap Global Positioning System (GPS) recorded the times and positions.

Methodology

The observers recorded the vessel *Willassen Senior* as it left the port of Vardø (N70° 22' E31° 06') at 6.50am on 18th May 2005. The *Willassen Senior*, (vessel registration number NOO4IV) is owned by Willassen Senior, a limited liability company owned by Hans Magne Willassen and Otto Harald Willassen. It is a 27.08 metre steel vessel of 245 tonnes built in 1979 and licensed to hunt minke whales⁸. Hans Willassen skippered the vessel on 18th May 2005⁹.

Continuous footage was shot for around two and quarter hours - one hour before the firing of the harpoon at 11:10 and then for a further hour and a half after. Unedited rushes of the hunt run on tapes numbered 1 to 4 and are continuous (excluding 14 minutes during which time the observers moved to a new location, and a total of 1 minute for tape changes, for which the camera was zoomed out to record GPS data). The observers filmed the vessel operating at a distance of about 300-500 metres from the shore just north of the village of Ytre Kiberg. The crew aboard the vessel were unaware that the hunt was being documented. The vessel's movements were observed until its return to the port of Vardø at 20.00 on the same day.

For viewing and editing the footage the masters were loaded directly into a Mac computer running the editing software Final Cut Pro 5. After editing, the video film was transferred directly back to Hi-Definition tapes with no loss of quality. Of primary interest was the local time and date, which were recorded on the data coding of the master tapes, which were viewed, frame-by-frame to compile the transcript of the hunt. The high definition produced by the camera enabled the frames to be zoomed, revealing more detail.

In the production of the DVD of the hunt, a counter is shown on the DVD, recording actual hours, minutes, seconds and 25th/sec (00:00:00:00), commencing 0.08 second before the first sight of the blast from the harpoon gun and runs for 14 minutes 54 seconds. Reference to the counter in this paper is shown in italics (00:00:00.00).

References:

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