SHORT COMMUNICATION

THE USE OF ELECTRICITY TO KILL MINKE WHALES: HUMANE CONSIDERATIONS

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Whaling continues despite a global moratorium, and the methods of slaughter used are a controversial welfare issue. If a whale is not killed instantly by an explosive harpoon, the Japanese use electric lances as a secondary killing device.

Video footage was obtained which documented the sequence of events in Japanese whaling operations, including the harpooning and application of electric lances to seven whales. A minimum time to death of each whale was estimated. To achieve immediate insensibility using electrical stunning, the electrodes must span the brain. This video revealed that electrodes tend to be placed between the pectoral and dorsal fins, and on the same side of the whale. In this case only a small proportion of current would pass through the brain, and ventricular fibrillation is unlikely. Previous work has shown that the currents used were likely to be 50–100 times too small to cause cardiac fibrillation or cerebral dysfunction.

A humane death cannot be achieved with inappropriate placement of lances and inadequate current application. A more effective secondary killing method is necessary.

Keywords: *animal welfare, whales, whaling, harpoons, electric lances*

Introduction

Despite the existence of a global moratorium on commercial whaling agreed by the International Whaling Commission (IWC) in 1982 and implemented in 1985/86, whales continue to be killed for both commercial and scientific purposes. In recent years the methods used to kill whales, reviewed by Kestin (1995), have come under considerable scrutiny on welfare grounds.

The standard weapon used in minke whaling is the grenade tipped, or explosive, harpoon. The position of a harpoon strike in a whale's body will influence its lethal impact, instant death is most often achieved when detonation is in the head or thorax (Government of Japan 1983). It is of note that in past years, including the 1992/93 season, gunners were instructed not to aim at the head of a whale (Government of Japan 1993) to facilitate collection of earplugs for ageing purposes.

If a whale is not killed instantly by an explosive harpoon, a secondary killing device is generally employed. The Japanese have used electric lances for this purpose since 1971 (Government of Japan 1993). Each lance is a 90cm, steel rod with a sharpened, flat head. The upper portion of the rod does not enter the whale and is insulated with tape. This is attached to a long pole which is used to implant the lance into the whale. Once the whale has been winched alongside the catcher vessel, normal use of the electric lance involves one being

placed in the vicinity of the heart, and the other planted on the dorsum slightly above the lateral line (Government of Japan 1993). The lance normally delivers 5 amperes at 100–110 volts and 50 or 60 hertz into the body of the animal (Hasui 1980; Hayashi 1980). Onboard the vessel under study, however, 220 volts were in use.

The Japanese government have documented the methods used to assess the time of death in whales taken during the 1992/93 Antarctic season in the following manner: '*In cases of non-instantaneous death, death was declared when the whales muscles became relaxed, its mouth opened wide, and its lower jaw drifted in the waves. When it was necessary to apply electric lances to kill the whale the current was turned on and off several times. When the whale's body ceased to react to application of the electric current, the last time the current was applied prior to that application was recorded as the time of death*' (Government of Japan 1993).

Detailed accounts of whaling operations which allow assessment of the humaneness of the kill are scarce. The examination of video film that is the basis of this communication presents a unique insight into the sequence of events that occurs when whales are killed in Japanese whaling operations. The use of electric lances as killing tools and their efficacy against the target animal are described.

Methods and materials

In 1992 a freelance film maker was permitted by the Japanese Fisheries Agency to video all aspects of the Japanese whaling fleet in operation during the five months of the 1992/93 Antarctic season. The capture of numerous whales and the death of seven were recorded over a four-week period spent onboard one of the catcher vessels. Because the person filming was not purposefully reviewing the methods used to kill these animals, the video footage has numerous cuts throughout. The number of cuts in each videoed sequence varied, and the duration of each cut was unknown. However, by timing the footage from the moment of initial harpooning until the presumed time of death, it was possible to estimate a minimum time until death for each animal. It was also possible to record in some detail the application of the electric lances.

Time zero was the moment at which the harpoon hit the whale with the exception of one whale which was already secured alongside the vessel when the film sequence commenced.

It was not possible to use Japanese government criteria (see above) to assess time until death as it was impossible to identify the time at which the lance operator applied the final lethal current. Instead, death was recorded as occurring at the time of the whale's last apparent movement. It is possible that some such movements had been caused either by the stimulation of muscles by the electric lance or by the force of waves on the body of the animal. When this was considered possible, the previous movement was taken to be the point at which death occurred.

The application of the lances was monitored by noting the position of their insertion into the whale and by listening for the sound of the current being switched on and off by the operator.

Results

The position of harpoons and electric lances.

The position of the harpoon(s) and electric lances recorded in each of the seven whales are illustrated in Figure 1. One harpoon hit each animal with the exception of whale 3 which was hit by two harpoons before electrocution commenced. It can be seen that the positioning of the lances varies markedly between whales, sometimes incorporating three or four placements. Positioning of the lances in whale 2 was not recorded due to an inability to view the precise placing of the lances in this whale throughout the film sequence.

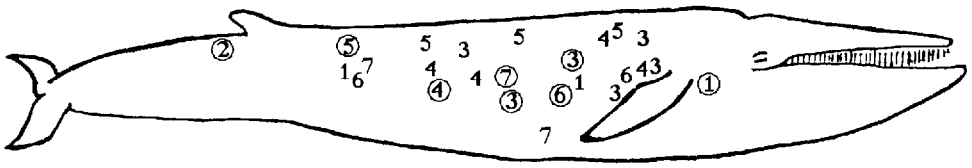

Figure 1 **Position of harpoons (circled numbers) in all seven whales, and lances for whales 1, 3, 4, 5, 6 and 7.**

Time until death

Table 1 provides details of some of the events which occurred throughout the death of each of the seven whales. As can be seen the number of cuts in each videoed sequence varied between two and eight, and the minimum time until death ranged between 1 minute 36 seconds and 8 minutes 21 seconds.

Table 1 **Events recorded during the death of each of the seven minke whales.**

Whale	Estimated minimum time taken to die	Number of cuts in film	Number electric lances	Time first lance inserted	Time last lance removed
1	7min 12s	4	2	3.13	8.13
2	2min 23s	3	2	1.58	2:09[@]
3	8min 21s	8	4	6.24	8.52[*]
4	5min 50s	2	4[+]	1.48	6.17
5	6min 16s	5	3	2.43	6.24[*]
6	2min 38s	3	2	1.59[#]	2.43[*]
7	1min 36s	3	2	1.18[#]	5.08

[@] time recorded after break in filmed sequence when lances no longer in body
* time film ended – lances still in body
\+ four sites of lance placement, one lance removed from body and replaced during sequence
\# filmed sequence did not capture initial insertion. Time represents stage at which lance first seen in animal

Discussion

With reference to the humane slaughter of domestic animals, electrical stunning can be divided into two main types; 'head only' and 'head-to-body'. In both cases a current must be delivered across the head. In the former the anticipated result is a direct effect upon the brain rendering it instantly insensible. 'Head-to-body' stunning involves the use of electrodes which span the brain and the heart simultaneously, stunning the animal and causing cardiac arrest (Anon 1992).

To achieve immediate insensibility in domestic animals it is considered that the electrodes must span the head so that the current passes through the brain (Blackmore & Delany 1988). Incorrect placement of electrodes in 'head-to-body' stunning can result in insufficient current passing through the brain and the animal may be subjected to painful muscular spasms before insensibility is reached. If sufficient current has been passed through the brain to cause depolarization of neurones and associated insensibility, the result is invariably an epileptiform seizure of the 'grand mal' variety lasting for about 45 seconds (Blackmore 1992; Anon 1992). Such epileptiform seizures have not been recorded in whales killed by electrocution, and were not witnessed in any of the seven animals observed here.

In 1994 the preliminary results of work investigating the likelihood of inducing brain and cardiac dysfunction by applying electrical currents to whales were presented to the IWC (Blackmore *et al* 1994). Using apparatus that was designed to deliver electrical currents similar to, or greater than, those used in whaling operations, measurements were made of the electrical impedance of dead cetacean tissues, and current densities in various parts of the body including the heart and brain. The preliminary conclusions of this work suggested that it would be virtually impossible for the electrical current administered by Japanese whaling operations to have any obvious effect on the brain and heart of animals similar in size to the minke whale. Based on known physiological data and a comparison with the electrocution of other large animals, it was estimated that the currents used were likely to be 50–100 times too small to be effective in causing cardiac fibrillation or cerebral dysfunction.

The video film considered in this study revealed that electrodes tend to be placed between the pectoral and dorsal fins. Only a small proportion of the current administered through electrodes placed in this manner will pass through the brain. Additionally, lances were placed on the same side of the animal thus making it unlikely that instant ventricular fibrillation occurred, even if a current of adequate strength had been applied.

Taking into consideration animal physiology, including whale anatomy, the response of animal tissue to electrical current and the results of the Blackmore *et al* 1994 paper, there is ample evidence that not only are the electric lances often placed inappropriately, but that even if placed correctly, the current applied would be inadequate for the purposes of causing a humane death.

Animal welfare implications

The IWC defined humane killing as causing death without pain, stress or distress perceptible to the animal (Anon 1980). If a harpoon fails in its objective and a secondary killing device has to be used, these criteria cannot be upheld. Despite this, secondary killing should adhere to the same IWC definition and ought to render the animal instantly insensible until death occurs.

The electrocution of minke whales as currently practised by Japanese whaling operations is likely to inflict great pain on the target animal. To ensure a more humane death for whales targeted in these operations, the development of more effective secondary killing methods is imperative.

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