Letters

Minke whale hunt and animal welfare

SK Knudsen*[†‡], EO Øen[†] and L Walløe[§]

[†] The Animal Department, Faculty of Medicine, University of Tromsø, NO-9037 Tromsø, Norway

[‡] Section of Arctic Veterinary Medicine, Department of Food Safety and Infection Biology, Norwegian School of Veterinary Science, PO Box 6204, NO-9292 Tromsø, Norway

[§] Department of Physiology, University of Oslo, PO Box 1103 Blindern, 0317 Oslo, Norway

* Contact for correspondence and requests for reprints: siri.knudsen@fagmed.uit.no

Over the last twenty-five years, Norway has given priority to research to improve hunting methods for Minke whales. This has resulted in an increase in the instantaneous death rate (IDR) from about 17% in the early 1980s to about 80% today, and, thus, in a considerable decrease in the time to death (TTD) (Øen 2003). TTD data have been collected by official veterinary inspectors on board Norwegian whaling vessels and reported annually to the International Whaling Commission (IWC) since 1983. Estimates of TTD have been based, predominantly, on the 'criteria of death in whales' that were established at an IWC workshop in 1980 (IWC 1980). These criteria in principle require complete immobility, ie a whale can only be pronounced dead if it has stopped moving, the jaw and flippers have slackened, and it is sinking passively. However, as early as 1995 the IWC agreed (IWC 1995) that the criteria were incomplete and sometimes misleading, as they did not allow for reflex movements and seizures that occur in the unconscious state after an animal is stunned. This phenomenon is well-known from the slaughter of domestic animals (for review, see eg Knudsen 2005). The IWC identified a need for a more reliable method of determining the time of onset of permanent insensibility in whales (IWC 1995) and in particular asked for research investigating in detail the trauma, and its consequences, caused by hunting methods.

In 1997-2004, two studies were conducted at the Norwegian School of Veterinary Science. One concerned the development of a new and improved penthrite harpoon grenade for Minke whales and the other was on methods of assessing time to insensibility or death in hunted Minke whales by investigating the trauma produced, with special emphasis on the central nervous system. Gross and histopathological changes after detonation of a harpoon grenade were investigated and described in 37 animals. The ability to penetrate the skull and the pathological effect of the two rifle calibres .375 and .458 were investigated in 29 animals. The results obtained in these studies have been reported to the IWC (IWC 2003) and published in international peer-reviewed scientific journals (Knudsen *et al* 2002; Knudsen & Øen 2003; Knudsen 2005), and formed the basis of a doctoral thesis (PhD) at the Norwegian School of Veterinary Science (Knudsen 2004).

In a recent short communication in *Animal Welfare*, Knowles and Butterworth (2006) commented on these Norwegian studies. As the basis for their commentary, they used two schematic diagrams from Knudsen (2004) indicating the approximate detonation sites of the penthrite grenades in the Minke whales studied. Knowles and Butterworth (2006, p55) state that they used a statistical model, which is not described in their article, to construct a similar figure (p 57). Apart from a few design modifications, their figure is a direct replicate of Knudsen (2004), but this is not acknowledged. The communication from Knowles and Butterworth (2006) does not report any new analysis of the material. However, in our view there are a number of misquotations of the original data and various misconceptions and misinterpretations in their commentary that, taken as a whole, invalidate the conclusions reached by the authors.

Knowles and Butterworth (2006, p 55) state that the data presented by Knudsen were collected on two different boats during the 1998-2000 hunting seasons, although all the published material (Knudsen *et al* 2002; Knudsen & Øen 2003; Knudsen 2004; Knudsen 2005) clearly states that the sampling took place during *four* field seasons (1997-2000) and that the samples of animals to be investigated for trauma caused by the penthrite grenade and the samples of animals that had to be re-shot with the back-up rifle were collected during different periods. These inaccuracies lead Knowles and Butterworth (2006, p 57) to indicate that there is a disparity between their calculation of what they term the "average rate of immediate immobilisation" (given as 54%) and the IDR rate reported for the Norwegian hunt as a whole (80%). However, their calculation is invalid: the data in Knudsen (2004) cannot be used for IDR percentage analysis because the two different categories of samples were collected during different periods and on different boats. Also, during the first part of the field sampling early prototypes of the new grenade with 30 g of pressed penthrite were used before the final version (Whalegrenade-99) was introduced.

Knowles and Butterworth (2006, p55) state that Knudsen (2004) recorded detonations in the Minke whales as either having or not having resulted in immediate *immobility* based on the IWC criteria. This is misleading because the Knudsen (2004) study compared the detonation site with *pathological lesions* inflicted by the detonation on vital organs, in particular the brain, to determine whether the penthrite grenade could have caused immediate or rapid insensibility (Knudsen & Øen 2003; Knudsen 2004). This, rather than immobility, is the relevant measure with regard to animal welfare. These results showed that intra-body detonation of a penthrite grenade can cause severe and fatal

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neurotrauma and that the area within which a detonation may be instantaneously or very rapidly lethal, ranges from the dorsal skull to the rostral abdomen. The neurotrauma varied from very severe brain tissue laceration with almost total disintegration of gross architecture, concomitant skull fractures and regular decapitation, and massive gross evident bleedings in meninges and brain substance, to histologically-evident intra-cerebral haemorrhages in central vital brain areas resembling acceleration-induced diffuse traumatic brain injury (dTBI) (Knudsen & Øen 2003). The pathological findings were thereafter used in conjunction with recorded behavioural observations to *evaluate* the IWC criteria (Knudsen 2005); the criteria were not used to determine time to unconsciousness/death, as Knowles and Butterworth state. This confirmed that whales, like any other mammal, may show agonal reflex movements after they must have lost consciousness, and that *immobility* is not a valid measure for evaluating the animal welfare implications of hunting methods (Knudsen 2005). The conclusions were that when TTD in whales is determined solely on the basis of the IWC criteria, a significant proportion of the animals will be recorded as being sensible or alive when they are in fact unconscious or dead (Knudsen 2004, 2005).

In their discussion, Knowles and Butterworth (2006, p 56, paragraph 1) present what appear to be *their* theories on the possible mechanisms by which the detonation of a penthrite grenade causes injury. These are in fact quotations from Knudsen and Øen (2003). For the interested reader, the original publication presents a review of relevant ballistic literature as the scientific basis for the proposed injury mechanisms (Knudsen & Øen 2003).

In addition to incorrect citation of original publications, and in some cases, failure to acknowledge them, Knowles and Butterworth also demonstrate a lack of technical knowledge of the hunting methods. There is apparent confusion about difference between the 'harpoon' and the 'harpoon grenade' as well as about the 'impact site for the harpoon' and the 'detonation site of the harpoon grenade'. They claim that one "harpoon misfired" (Knowles & Butterworth 2006, p55). If that were the case this whale would still be swimming in the sea. In addition, Knowles and Butterworth (2006, p56) use the designation 'impact site' in their figure. In ballistic terminology 'impact site' is equivalent to point of impact or 'hit point', which in this context relates to the 'harpoon' rather than the 'grenade'. The harpoon travels through the animal, usually at an oblique angle when the animal is shot from the side, while the harpoon grenade is designed to detonate in vital organs inside the animal during the course of the milliseconds it takes for the harpoon to pass through the whale's body (Øen 2003). This means that the exact hit point for the harpoon is not critical: the relevant question is which organs are affected by the detonation of the grenade. The detonation has been proved to have a much wider impact area than the harpoon itself (Knudsen & Øen 2003). The figures presented by Knudsen (2004) and replicated by Knowles and Butterworth (2006, p56) do not show the impact site for the harpoon, but the recorded detonation site of the harpoon grenade. This is a significant difference, as hits with a harpoon at various different areas on a whale may result in exactly the same fatal injuries as a result of the detonation of the harpoon grenade.

It is not reasonable to conclude, as Knowles and Butterworth (2006) do, that the abdomen of the whale is a more critical target area than the area near the brain (Knowles & Butterworth 2006, p57). For reasons of animal welfare, we do not agree with this conclusion, but will continue to recommend that whalers should target the foremost part of the whale so that the harpoon grenade can cause fatal damage to the brain and the vital organs in the thorax (heart, lungs, large blood vessels) and thus render the animal very rapidly or immediately insensible.

References

IWC 1980 Report of the Workshop on Humane Killing Techniques for Whales. *Report of the International Whaling Commission IWC/32/15.* 10-14 November 1980. Cambridge, UK

IWC 1995 Report of the Workshop on Whale Killing Methods. *Report of the International Whaling Commission IWC/47/18.* 23-25 June 1995, Dublin, Ireland

IWC 2003 Report of the Workshop on Whale Killing Methods and Associated Welfare Issues, *Report of the International Whaling Commission IWC/55/Rep. 5.* 7-9 June 2003, Berlin, Germany

Knowles TG and Butterworth A 2006 Immediate immobilisation of a Minke whale using a grenade harpoon requires striking a restricted target area. *Animal Welfare 15:* 55-57

Knudsen SK, Mørk S and Øen EO 2002 A novel method for in situ fixation of whale brains. *Journal of Neuroscience Methods 120:* 35-44

Knudsen SK and Øen EO 2003 Blast-induced neurotrauma in whales. *Neuroscience Research 46:* 377-386

Knudsen SK 2004 *Assessment of insensibility and death in whales.* PhD Thesis, The Norwegian School of Veterinary Science, Tromsø, Norway

Knudsen SK 2005 A review of the criteria used to assess insensibility and death in hunted whales compared to other species. *The Veterinary Journal 169:* 42-59

Øen EO 2003 Improvements in hunting and killing methods for minke whales in Norway 1981-2003. In: *Proceedings of the International Whaling Commission Report International Whaling Commission IWC/55/WKM&AWI 17*

Response to Knudsen, Øen and Walløe's letter 'Minke whale hunt and animal welfare'

TG Knowles* and A Butterworth

School of Veterinary Science, University of Bristol, Langford, Bristol, BS40 5DU, UK

* Contact for correspondence and requests for reprints: Toby.Knowles@bristol.ac.uk

The points Knudsen, Øen and Walløe raise do not in any way alter the conclusions as presented in Knowles and Butterworth (2006) that: "The data drawn together in this commentary suggest that in order to cause immediate immobilisation and, perhaps, an immediate stun in Minke whales harpooned using the Norwegian 'Whalegrenade-99'

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