

**Welfare aspects of the
Canadian seal hunt:
final report**

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Executive summary

- In this report, we present data from three sources to examine the welfare aspects of the commercial Canadian seal hunt as it currently operates. These sources are: (i) 17 *post mortem* examinations of harp seal pups killed in 2007; (ii) videos supplied by the International Fund for Animal Welfare (IFAW) and the Humane Society of the United States (HSUS) showing 169 seals killed by over 20 different sealing boats during the hunts in 2003, 2004, 2005, 2006 and 2007; and (iii) an Expert Opinion Analysis where 133 experts were sent 30 randomly-selected timelines where each showed the sequence of events extracted from the videos for a single seal kill and asked "How do you rate the overall welfare of this animal during the processes which resulted in its death?".
- Both the seal carcasses and the videos were a random sample and the data in this report provide a comprehensive overview of the pattern of sealing undertaken across a broad spectrum of ice conditions and by different sealing boats in the years since two earlier reviews on welfare aspects of the hunt in 2001.
- Of the 17 seals examined *post mortem*, all had been clubbed (one had also been shot). Of these, 47% had been clubbed on the face or neck, and 82% had ocular damage. At the end of the *post mortem* examination, each animal was given three likelihood scores of 1 to 10 (where 1=good welfare, 10=poor welfare) by the person who undertook that *post mortem* examination, based on his assessment of whether: the animal was dead at the time of skinning; the animal had been rendered insensible immediately; and the animal had suffered distress following the first insult. Based on these scores, and two other measures (whether blood was present in the stomach and the presence of facial injuries), there were no welfare concerns for 2 of the 17 seals. For the other 15, there were substantial concerns about the way they had been killed.

- From the videos, we were able to establish the start sequences for 88% of 169 seals that were killed; of these, 37% were shot first, 63% were clubbed first. Irrespective of whether they were first shot or clubbed, a blinking reflex test and/or cranial palpation was only undertaken in 33% of cases, and these often appeared to be performed in a superficial manner which cast doubts on the adequacy of the way the tests were performed.
- Of the seals that were shot, 78% were shot once. Of 51 shots where the point of impact could be established, 41% were in the head region, 55% in other parts of the body, and 4% missed. Most shot seals (66%) subsequently needed to be struck with a hakapik or club, and a further 16% were responding to stimuli after being shot but were not clubbed. Thus 82% of shot seals were not killed by the first shot. The mean duration of time from first shot to contact by the sealer was 48.8 ± 9.4 seconds, indicating a substantial period of potential suffering before the sealers could have ensured that the animals were insensible.
- Wounding rates when seals were shot were extremely high, even though at least 8 (57%) of 14 rifles used to shoot seals had telescopic sights (for four it was unclear, two did not have telescopic sights). Sealers did not usually shoot a seal twice, even when it was obviously wounded by the first shot, presumably because the animal had been at least partially immobilised with the first shot, and further shots would reduce the value of the pelt. There are many practical problems when trying to shoot seals from a boat, even in a relatively calm sea (the boat is moving, the ice is moving, and seal may also be moving), and these lead to high levels of wounding. Since it is not possible to address these problems, shooting seals from boats should be viewed as inherently inhumane since it is highly improbable that improvements in current practices could lead to internationally acceptable standards of welfare.
- Clubbing appears to be the preferred method of killing seals in the Gulf and is invariably used when ice conditions permit. Yet even this leads to high levels of wounding, and most seals are not checked by the sealers. Of the seals that

were clubbed, 39% required two separate series of blows: mean time between series was 23.9 ± 3.2 seconds. The delay was because sealers would chase after escaping seals, striking them in sequence rather than stopping to determine whether each seal was dead before moving on to another. Furthermore, sealers would club seals whilst chasing after them, thereby preventing the accurate placement of blows, and sometimes the hakapik was only held in one hand, thereby reducing the power of the blow that was delivered. After being clubbed, 25% of seals (12% received one series of blows, 13% more than one series of blows) subsequently showed responses to stimuli.

- Of the 100 sequences where we could time events from the first insult to last action, the mean duration was 38.9 ± 3.4 seconds (range 1-162 seconds). However, these times should be viewed as minima due to restrictions caused by filming.
- Large numbers of seals are killed in a few days, and there is competition between sealers to collect as many skins as possible before the hunt is closed. Effectively, it is a 'gold rush'. Bearing in mind that guidelines on how to kill seals have been issued by the Canadian authorities, and that the conditions under which the sealers operate are difficult, it is concluded that the commercial and practical pressures that the sealers are under make clubbing of seals inherently inhumane. We do not believe that it would be possible to improve practices such that this method of killing would reach internationally acceptable standards.
- A blinking reflex test or cranial palpation was only performed on 21% of the seals that were observed to be gaffed; 44% of gaffed seals showed responses to stimuli after being gaffed.
- Skinning or cutting with a knife was only observed in 18 seals; the majority of these (14) were in 2003. Skinning was rarely filmed in other years (one in 2004, two in 2005, none in 2006, one in 2007) because there was a longer

delay between shooting/clubbing and skinning. Of the skinned seals, only 4 (22%) were checked prior to the onset of skinning, whereas 15 (83%) responded to stimuli after cutting had begun. In 33% of cases, the sealers stopped cutting to club the seal again. These figures may not be typical of all years; in years where skinning is delayed, these figures are likely to be lower.

- Welfare concerns are consistent between years, indicating that they are not associated with particular ice conditions. The data from this study are in remarkable agreement with two studies conducted by other investigators in 2001. This shows that there have been no improvements in welfare standards over the last six years, despite these problems having been highlighted in the past and despite recommendations from the Independent Veterinarian's Welfare Group, which was established by the federal government to improve welfare standards.
- There was a widespread disregard for the Marine Mammal Regulations and non-statutory regulations from the sealers' professional bodies. A maximum of only 15% of seals we observed on the videos were killed in a manner that conformed to the Marine Mammal Regulations; because we did not have continuous sequences for all seals, this is a maximum figure since violations could have occurred during the period when events were not being recorded.
- The failure to improve standards over the last six years shows a lack of willingness and/or ability to address welfare concerns, and the low level of adherence to the Marine Mammal Regulations shows a widespread failure by the Canadian Department of Fisheries and Oceans to monitor the hunt effectively and/or enforce the Marine Mammal Regulations. Since this is the largest marine mammal hunt in the world, with around 300,000 seals killed each year, this is a significant welfare issue.
- Fifty-three international experts took part in an expert opinion analysis; they were sent 30 randomly-selected timelines showing a summary of the events that occurred for the 100 seals for which we had video data showing the entire

sequence of events. Of 1503 submitted scores, 33.7% indicated good welfare, whereas 44.6% indicated bad welfare. The most significant factor that explained variation in scores was the duration of the timeline; the experts generally considered that good welfare occurred when all events occurred within 15 seconds. This was less than half the average duration of the timelines, which were in any case biased towards shorter events; only 30% of timelines were ≤ 15 seconds long.

- However, some short time sequences also had high (i.e. bad) welfare scores, indicating that the experts also considered other factors to be important. Gaffing before death and cutting/skinning before death both significantly increased (i.e. worsened) the welfare scores. Whilst checking that the animal was insensible or dead improved the welfare scores, the significance of this variable was lower than for other variables because checking was often inadequate and the seal was subsequently gaffed or cut/skinned whilst still sensible.
- There was a striking similarity between the mean welfare scores given by the three experts who examined the seal pups *post mortem* (5.2 ± 0.6 , scale 0-10) and the mean welfare scores for the timelines examined by the panel of international experts (56.1 ± 1.0 , scale 0-100); higher scores indicated bad welfare. Thus using different approaches and different groups of experts to assess the welfare of the commercial Canadian seal hunt led to very similar outcomes, and we believe that the conclusions presented here are robust and reflect the views of a wider scientific community.
- We compare the welfare standards of the seal hunt with the expectations in commercial slaughterhouses in both the EU and Canada. The likelihood of a single effective shot or strike in despatching seal pups is well below the corresponding standards achieved for animals in slaughterhouses. Since the number of affected animals is large, and the levels of wounding are high, the hunting method should be considered unacceptable.

Introduction

One of us (Stephen Harris) was asked by HSUS and Respect for Animals to assemble a small team of veterinary scientists and zoologists with relevant expertise to consider the following aspects of the Canadian commercial seal hunt:-

- Whether there is any evidence of individual suffering of the seals on a case by case basis and to document what is experienced by the seals up to and during the kill;
- Whether there was any evidence of violations of Canadian law, including the Marine Mammal Regulations and the Criminal Code of Canada;
- Whether sealers comply with recommendations on humane killing made by government established veterinary panels and the sealing industry and to document cases where this does not occur;
- Whether the culling practices conform to international/European standards on humane slaughter and to document cases where this does not occur; and
- Whether there is any evidence that the seal hunt is inherently inhumane.

The team consisted of Andy Butterworth, Pierre Gallego, Neville Gregory, Stephen Harris and Carl Soulsbury. There have been a number of previous reviews into welfare aspects of the hunt, the most recent being Burdon *et al.* (2001), Daoust *et al.* (2002) and Smith (2005), and extensive reviews of the hunt's management objectives and economic benefits (Johnston *et al.*, 2000; Anon. 2004; Keddy, 2007), the ethics of the hunt (Linzey, 2006) and the impact of climate variability on harp and hooded seal populations (Johnston *et al.*, 2005). In this report, we only consider the welfare aspects of the hunt as it currently operates and whether there have been any significant welfare improvements since the reports published by Burdon *et al.* (2001) and Daoust *et al.* (2002).

Stephen Harris had previously observed the hunt from the ice and from helicopters in 2001. Four of the assembled team (Andy Butterworth, Pierre Gallego, Neville Gregory and Stephen Harris) attended the seal hunt in 2007, but permit restrictions limited the opportunity to observe the hunt directly from helicopters. They were however able to examine the carcasses of 17 freshly killed harp seals; these were recovered from the ice or sea at random once the seals had been skinned and the carcasses discarded by the sealers.

In addition, video recordings of the commercial Canadian seal hunt made during 2003, 2004, 2005, 2006 and 2007 were sent to the team by the HSUS. These recordings were analysed by members of the team, and summary data extracted from the videos were also used for an expert opinion analysis. The following information on sealing practices, how the video data were collected and the footage compiled, and the ice conditions each year, was supplied by Rebecca Aldworth of HSUS.

Sealing practices under different ice conditions

Sealing practices vary according to the ice conditions. When ice conditions permit, sealers club the seals on the ice floes. This is the preferred method of killing because processing companies deduct money for every bullet hole found in the skin. When the ice conditions do not allow sealers to work on the ice, the seals are shot from boats at distances of up to 100 metres. If the ice is solid enough, the sealer will then jump onto the ice to retrieve the shot seal. If the seal is obviously only wounded, the sealer may club the seal on the ice prior to gaffing it. The gaff is usually inserted into the face or under the lower jaw to avoid damaging the pelt, and the animal is then dragged across the ice and up onto the vessel. If the ice is not strong enough for the sealer to stand on, he will lean over the edge of the boat and retrieve the seal by gaffing it through the jaw or another part of the body and hoisting the seal onto the boat; this is done even though the seal has not been checked to determine whether it is still sensible. Sometimes, when the seal shows signs of movement or responds to stimuli, the sealer will subsequently club it on the deck. Not all shot seals are recovered; some are “struck and lost” i.e. they slip or escape into the sea.

Methods of filming

Filming of the commercial seal hunt by HSUS and IFAW was undertaken in three ways:-

- From the ice using video cameras, when filming can be undertaken no closer than 10 metres from the sealers;
- From rigid inflatable boats using video cameras, when filming can be undertaken no closer than 10 metres from the sealers; or
- From the air with the use of a Wescam (a high powered lens mounted on a helicopter), when filming is restricted to no closer than 500 feet to the side and 1000 feet overhead.

Filming took place in the southern Gulf of St. Lawrence, the eastern Gulf of St. Lawrence, the northern Gulf of St. Lawrence and the “front” (waters northeast of Newfoundland). The sealers filmed were primarily from the Magdalen Islands and Newfoundland. Hunting methods were consistent regardless of the area.

In each year, the filming was co-ordinated by Rebecca Aldworth, on behalf of IFAW (2003 and 2004) or HSUS (2005, 2006 and 2007). Vessels and crews that were filmed were selected at random; each year every attempt was made to film as many individual sealers from as many different vessels as possible. When using a helicopter, filming was often undertaken from distances that made it impossible to identify the names of the vessels in the field (although it was often possible to identify either the name or number of the vessel subsequently when viewing the video on a large monitor); this prevented intentional bias when filming. The video footage was then compiled and edited prior to being copied and forwarded to the authors of this report for analysis. Irrelevant material (i.e. scenes that did not involve hunting) was excluded from the compilations. However, there was no selective editing of the films, and all incidents of hunting that were filmed were included, with as much detail as it was possible to document. Thus the videos were a representative sample of the

sealing practices filmed each year and there was no attempt to pre-select the material that was sent for analysis.

The hunt in 2003

Ice cover in the Gulf of St. Lawrence in 2003 was very heavy, with large pans of thick ice stretching for kilometres. Fishermen said it was the heaviest ice they had seen in 30 years. As a result, seal hunters operated entirely on the ice in the Gulf, clubbing the seals instead of shooting them from boats. The vessels were from the Magdalen Islands and Newfoundland. The ice drifted into the eastern Gulf; the IFAW team was based in western Newfoundland and travelled to the seal hunt by helicopter. They then walked to where the sealing crews were hunting and filmed from a minimum distance of 10 metres. A large number of vessels surrounded the edges of the ice floes, and sealers travelled across the ice floes by skidoo and on foot.

At the end of March, the commercial seal hunt in the eastern Gulf of St. Lawrence was documented. In mid-April, IFAW attempted to film the seal hunt in the “front” with the use of a Wescam mounted on a helicopter, but the distance of the vessels offshore prevented effective filming. Thus, they refocused on filming the hunt in the northern Gulf of St. Lawrence, where a number of sealing vessels from Newfoundland were operating; IFAW flew to the area of the seal hunt by helicopter.

The hunt in 2004

Ice cover in the Gulf of St. Lawrence in 2004 was far less heavy than in 2003, but still solid enough to enable sealers to travel on skidoos and on foot across the ice. Some sealers moved around the floes in “skiffs” (small motor boats). The ice rapidly disintegrated, and towards the end it was very difficult for the helicopters to land on the ice floes. Seal hunters mostly clubbed seals on the ice, but towards the end of the recording period some of the sealers had begun to shoot seals from their vessels. The vessels were from the Magdalen Islands and Newfoundland.

From March 24 to March 30, the commercial seal hunt in the southern Gulf of St. Lawrence was documented. The IFAW crew travelled to the seal hunt by helicopter,

landed on the ice and proceeded on foot to areas where sealing crews were actively hunting. They were filmed from a minimum distance of 10 metres.

The hunt in 2005

Ice cover in 2005 was roughly the same as in 2004. Seal hunters largely operated on the ice, moving around in skiffs to reach various sections of the floes, and clubbing the seals. The vessels filmed were from the Magdalen Islands and Newfoundland.

From March 29 to April 3, the commercial seal hunt in the southern Gulf of St. Lawrence was documented. HSUS crews travelled to the seal hunt by helicopter, landed on the ice and proceeded on foot to areas where sealing crews were operating. They were filmed from a minimum distance of 10 metres.

The hunt in 2006

Ice cover in 2006 was far less heavy than in 2005. Broken, small pans of ice were scattered across the Gulf of St. Lawrence. Sealers travelled through the ice floes in their vessels, shooting at the seals, and hopping onto the small ice pans to club/recover the seals when possible. The vessels filmed were from the Magdalen Islands.

On March 25 and March 26 HSUS documented the commercial seal hunt in the southern Gulf of St. Lawrence. They travelled to the seal hunt in a 120 foot vessel, and moved into the hunt areas on two rigid inflatable boats; they filmed the activities of several sealing crews from a minimum distance of 10 metres. However, the Department of Fisheries and Oceans refused to renew their observation permits after March 26, and so their documentation of the 2006 seal hunt in the southern Gulf of St. Lawrence ended then.

In mid-April, HSUS filmed the seal hunt for two days using a Wescam mounted on a helicopter. On the first day HSUS filmed hunting in the northern Gulf of St. Lawrence, on the second day they filmed in the "front". The sea ice in both these areas was very broken up, with small pans of ice scattered across the ocean. Sealers shot at seals

from their vessels, and jumped onto ice pans where possible to club/recover the seals.

The hunt in 2007

Ice cover in 2007 was much more sparse than in 2006. Broken, tiny pans of ice were scattered across the southern Gulf of St. Lawrence, and the Canadian government estimated up to 100 percent mortality in the harp seal pup population in that area through natural drowning. Even in the northern Gulf, the ice was not strong enough to land a helicopter. Seal hunters largely operated by shooting at seals from their vessels and then jumping onto the small pans of ice whenever possible to club/recover the animals. The vessels filmed were from the Magdalen Islands and Newfoundland.

Filming was prohibited by the Canadian government in the southern Gulf of St. Lawrence on the opening day of the seal hunt. However, from April 4 to April 12 HSUS was able to document the hunting in the northern Gulf. They travelled to the area by helicopter and filmed the hunt with a Wescam. Vessels and sealers were selected at random, and HSUS attempted to film as many individual sealers from as many vessels as possible.

Summary

The video material from the five years 2003 to 2007 covers a wide range of ice conditions, and thus provides an overview of most of the conditions likely to be encountered during the commercial seal hunt in Canada.

The quota system

Each year, Canada's Minister of Fisheries and Oceans sets a quota for each species of seal that is commercially hunted in Canada; almost all of the seals killed are harp seals. Quotas are allocated by the Department of Fisheries and Oceans according to region and vessel size. Each region receives a total allocation, divided between longliners (vessels between 35 and 65 feet in length) and small vessels (under 35 feet in length). The greater share of the quota goes to the longliners (http://www.dfo-mpo.gc.ca/seal-phoque/reports-rapports/facts-faits/fleet_e.htm). Each region sets its

own opening date for the season in consultation with the Department of Fisheries and Oceans. Upon the opening day, all licensed vessels in the region are able to hunt for as many seals as they want, until the regional quota is reached. Vessels therefore compete against each other, killing as many seals as possible, as quickly as possible. The number of seals killed is established by monitoring at the dockside and daily hauls of catches for all sealing vessels, among other measures (http://www.dfo-mpo.gc.ca/media/backgrou/2007/hq-ac13a_e.htm).

This "gold rush" approach leads to a very large number of seals being killed in a just a few days. For example, 78 percent of the 2005 quota was taken in just six days. In the "front", it is common for about 145,000 seals to be killed in just two days. As an example of the intensive and competitive nature of the Canadian commercial seal hunt, in 2007, the longliner quota for the "front" was closed, despite the fact that there were 10,000 seals remaining. The Newfoundland seal hunt coordinator for the Department of Fisheries and Oceans explained that this was because "The 10,000-12,000 remaining would only be enough to sustain a competitive fishery for this fleet for an hour or two in good conditions".

The legal position

The Marine Mammal Regulations

The main piece of legislation that governs the Canadian seal hunt is the Marine Mammal Regulations (SOR/93-56), enacted in 1993. There are a number of requirements for sealers (Marine Mammal Regulations sections 28-29); these are enforced by the Canadian Department of Fisheries and Oceans, and govern the ways in which sealers can kill seals. For instance:-

- The Marine Mammal Regulations list the weapons that can be used to kill a seal; these are:-
 - i. a round club made of hardwood that measures not less than 60 cm and not more than 1 m in length and that, for at least half of its length, beginning at one end, measures not less than 5 cm and not more than 7.6 cm in diameter;

- ii. an instrument known as a hakapik, consisting of a metal ferrule that weighs at least 340 g with a slightly bent spike not more than 14 cm in length on one side of the ferrule and a blunt projection not more than 1.3 cm in length on the opposite side of the ferrule and that is attached to a wooden handle that measures not less than 105 cm and not more than 153 cm in length and not less than 3 cm and not more than 5.1 cm in diameter;
- iii. a rifle and bullets that are not full metal-jacketed that produce a muzzle velocity of not less than 1,800 feet per second and a muzzle energy of not less than 1,100 foot pounds; or
- iv. a shotgun of not less than 20 gauge and rifled slugs.

Thus the use of any other weapon, such as gaffs (long wooden poles with metal hooks on the end), to kill a seal is a violation of the Marine Mammal Regulations.

- The Marine Mammal Regulations state that “No person who kills or wounds a marine mammal shall (a) fail to make a reasonable effort to retrieve it without delay; or (b) subject to section 33.1, abandon or discard it.” The Marine Mammal Regulations also state that “No person shall fish for a marine mammal without having on hand the equipment that is necessary to retrieve it.” Thus any instances of wounded seals being allowed to escape are potential violations of the Marine Mammal Regulations.
- The Marine Mammal Regulations state that “No person shall attempt to kill a marine mammal except in a manner that is designed to kill it quickly.” Thus, leaving wounded animals without killing them expeditiously, clubbing ineffectively or shooting seals in areas other than the head are violations of the Marine Mammal Regulations.
- The Marine Mammal Regulations state that every person who strikes a seal with a club or hakapik shall strike the seal on the forehead until its skull has been crushed and shall manually check the skull, or administer a blinking reflex test, to confirm that the seal is dead before proceeding to strike another seal.

- The Marine Mammal Regulations state that every person who administers a blinking reflex test on a seal that elicits a blink shall immediately strike the seal with a club or hakapik on the forehead until its skull has been crushed, and the blinking reflex test confirms that the seal is dead.
- When seals are shot, the Marine Mammal Regulations require that “the person who shoots that seal or retrieves it shall administer a blinking reflex test as soon as possible after it is shot to confirm that it is dead.” The Marine Mammal Regulations also state that “No person shall attempt to kill a marine mammal except in a manner that is designed to kill it quickly.” Thus, any instances of sealers failing to ensure death quickly after shooting, such as failing to shoot a wounded seal again because this would reduce the value of the pelt, are a violation of the Marine Mammal Regulations.
- The Marine Mammal Regulations state that “No person shall start to skin or bleed a seal until a blinking reflex test has been administered, and it confirms that the seal is dead”. Thus, a sealer starting to skin a seal without confirmation of death is a violation of the Marine Mammal Regulations.
- According to the Marine Mammal Regulations, “Every person who strikes a seal with a club or hakapik shall strike the seal on the forehead until its skull has been crushed”. Thus blows to any part of the body other than the forehead (such as the nose, jaw, neck, body) are a violation of the Marine Mammal Regulations.

The Criminal Code of Canada

Section 446 of the Criminal Code of Canada says anyone commits an offence who “wilfully causes or, being the owner, wilfully permits to be caused unnecessary pain, suffering or injury to an animal or bird”.

Non-statutory recommendations

A number of (non-binding) recommendations have been made by veterinary panels established by the federal government to study the hunt. The most recent of these

were made by the Independent Veterinarians' Working Group (Smith, 2005). These recommendations include:-

- A three-step process of stunning, checking (palpation of the skull) and bleeding, which should be carried out in sequence as rapidly as possible.
- Seals should not be shot in the water due to the high potential for “struck and lost” events, suffering resulting from the inability to confirm irreversible unconsciousness, and potential for the loss of wounded animals.
- Competition and haste in the hunt should be reduced. This could have a positive impact on: humane practice, worker safety, monitoring and enforcement.
- The Department of Fisheries and Oceans should take steps to improve supervision, monitoring, compliance and enforcement.

In addition, the largest sealskin processing plant in Newfoundland – Carino Company Ltd. - has published a series of recommendations in its *Handbook for Sealers*. The relevant section states that:-

- “If a regulation hakapik is used, the seal should be struck on the top of the head three or more times until it is dead. If a rifle or shotgun is used, the seal should be shot in the head only. If a seal is shot in the body, the seal suffers needlessly, the value of the pelt is reduced and the meat is damaged. Regulations and humaneness require that a seal be dead before it is cut, bled, or gutted. A seal is dead when it is glassy eyed, has a staring appearance and does not blink when the eye is touched. If the seal is not dead, it must be struck on the head using the regulation club or the blunt head of the hakapik.”

Methods

Three sources of data are presented in this report.

Post mortem data

In 2007 carcasses of recently hunted and skinned seals were recovered from the ice or sea by helicopter and delivered to a central facility for *post mortem* examination by Andrew Butterworth, Pierre Gallego and Neville Gregory; all three are experts in *post mortem* procedures and welfare issues associated with various slaughter techniques. The carcasses were examined as soon as possible after death, and within eight hours of collection; some were observed during the killing and skinning process, and all were collected as soon as the hunters had vacated the area following the permitted access arrangements.

A protocol of measures and observations was carried out on each of the 17 carcasses examined, and a uniform recording system was applied to enable comparisons to be made between each animal. The measures are tabulated in Appendix 1. For the majority of measures, the findings were recorded using multiple choice options e.g. viscera colour (measure 23) was recorded as "dark, normal, pale or very pale", and stomach contents (measure 24) were recorded as "nothing, food or blood". Sites of anatomical lesions were noted e.g. gaff wound sites (measure 17) were recorded as "mandible/mouth, chest, neck, back or hind flipper".

For the remaining measures, the informed opinion of the person undertaking the *post mortem* examination was recorded e.g. the extent of skull damage (measure 8) or an estimate for the number of blows required to cause the lesions seen (measure 13), which was recorded as "none, mild/moderate or extensive", following the guidelines given in Burdon *et al.* (2001).

At the end of the *post mortem* examination, the veterinary scientist was asked to summarise his findings in a series of informed opinion questions. These questions were: "What do you consider to be the method of death?" (measure 26), scored as "clubbed head, clubbed neck, clubbed face or shot then clubbed"; "How confident are you that the animal was dead at the time of skinning?" (measure 27), where 0=very confident to 10=very unsure; "In your opinion, was the animal rendered insensible immediately?" (measure 28), where 0=immediately to 10=protracted period to

insensibility; and "Do you think that the animal suffered distress following the first insult?" (measure 29), where 0=no distress to 10=high levels of distress.

Video data

Data were extracted from the videos taken by IFAW in 2003 and 2004, and by HSUS in 2005, 2006 and 2007. We recorded the sequence of events where we could observe individual seals; where we could observe the entire sequence we were able to construct timelines. However, for many seals we were only able to record individual events, such as whether the seal was checked to determine whether it was dead after it had been shot or struck with a hakapik. Timelines were ended at: (i) the last time the seal was observed to respond to a stimulus; or (ii) where a check was performed by the sealer and no action was taken, suggesting that the sealer believed the seal to be dead; or (iii) a seal was clubbed and no further movement or response to stimuli was observed, or the sealer did not club the seal again; or (iv) at the onset of skinning, if the seal showed no response to the stimulus. We have assumed that, if a sealer returned to club a seal again, he believed that the seal was not, or may not have been, dead.

Responses to stimuli were those that required a coordinated response e.g. biting the gaff, resisting whilst being dragged or other coordinated movements, as opposed to uncoordinated movements which could be construed as a *post mortem* swimming reflex. A sealer is meant to check that the seal is dead by manually palpating the skull or by administering a blinking reflex test. Although many of the tests we observed appeared to be token i.e. the very briefest touch of the skull, or an attempt to test for a blinking reflex when the sealer was clearly not watching the seal's response, we took any act of touching the head or facial areas to indicate that the sealer had checked whether the seal was dead. Whilst it may be that a very brief touch of the head is adequate in at least some cases to determine the extent of cranial damage, the data presented here include situations where cranial palpation and/or the blinking reflex test were not performed adequately and so we have overestimated the number of seals that were tested by the sealers to determine whether they were dead.

Wherever possible, we determined location of gunshots based on the blood patterns on the ice. Although point of impact could not always be seen directly, blood in the vicinity of the flanks was taken to indicate a body shot, whereas blood in the region around the head was taken to indicate a head shot. It should be noted that, although the seal may be shot in the head, it does not necessarily represent a brain shot, since the bullet may have passed through the face or jaw. Thus the data presented here record the maximum number of seals that were shot in the head and may overestimate the prevalence of concussion.

For each seal, we recorded whether the legal requirements specified by the Marine Mammal Regulations were contravened. Since for many of the seals, the videos only showed part of the hunt, there is the potential for other violations to have occurred that were not recorded. Thus, the data presented here probably provide a minimum estimate of the number of violations.

Expert opinion analysis

One of us (Carl Soulsbury) compiled a timeline from the videos for each of the 100 seal kills where the entire sequence of events had been recorded. This showed when the seal: (i) was shot; (ii) was hit with an illegal implement; (iii) was hit with a legal implement; (iv) was gaffed; (v) last responded to stimuli; (vi) was checked to see if it was alive; and (vii) was skinned/cut with a knife. Not all events occurred during every sequence. This was a simplified summary of events to maximise response rates and to provide clarity. Thus when the timelines showed that a seal was hit, this could be one or a series of blows, and the blows could have landed on the cranium, face, neck or elsewhere. Similarly, when the seal was shot, the point of impact was not identified, and only the last response to stimuli was included in the timelines.

We asked 133 international experts (28 in Australasia, 72 in Europe and 33 in North America; 61 experts in Animal Welfare, 24 in Humane Slaughter of captive and/or wild animals and 48 in Marine Mammals) to participate in an expert opinion analysis. Each person was asked to look at 30 randomly-selected timelines, and to answer the question "How do you rate the overall welfare of this animal during the processes which resulted in its death?". Under each timeline there was a scale bar ranging from

0 (good) to 100 (bad); each participant was asked to place a slider on the bar to indicate their score. They had the option not to score any timeline for which they felt they were not, for any reason, able to offer a professional opinion. Participants had the option to do this online or, if they encountered problems with accessing the site, they were sent 30 randomly-selected timelines in a word file. The scoring system was the same whichever system was used.

Whilst most experts had at least some knowledge of the Canadian seal hunt, we also provided a simple explanation of what was occurring. Originally, we did not send video sequences with the timelines, but when some people asked for these, we identified two websites where they could view videos similar to the ones sent to us, should they so wish.

From each timeline, five factors were used to examine their influence on welfare perception: (i) expert type; (ii) duration of timeline; (iii) gaffed whilst sensible; (iv) cut/skinned whilst sensible; and (v) presence/absence of a check. Expert type was defined as AW (Animal Welfare), HS (Humane Slaughter) or MM (Marine Mammals). Gaffing, cutting/skinning and checking were categorised as yes/no. In addition to these variables, we also extracted information on the number of bouts of hitting and total number of events in each timeline. However, these were significantly correlated to some of the previously selected variables, so were not included in the model. Welfare scores were ARCSINE transformed and all parameters inserted into a generalized nonlinear model (GNM) designed for and run in R (R Foundation for Statistical Computing, 2007). Variables were inserted in the following order and by variable type: duration (random), expert (categorical), gaffing (categorical), cutting/skinning (categorical) and checking (categorical). We examined interaction terms between expert type and gaffing, cutting/skinning and checking.

Results

Post mortem data

Seventeen seals were collected for *post mortem* analysis: summary data are presented in Appendix 1. All seals had been clubbed, with one having been shot and clubbed.

Most seals had multiple fracture sites (Figure 1) and 59% had extensive damage to the skull (Figure 2). A significant number (59%) had pre-mortem bleeding in the mouth or nostrils. The majority of seals had sustained multiple blows (Figure 3). Whilst 88% of the seals had fractured skulls, clubbing sites were frequently recorded on other parts of the head or body. Thus 82% had ocular damage and a significant proportion (44%) had damage to the face or neck (Figure 4). In only one case was there evidence that the animal had been bled out. Whilst the most frequent site of gaff marks (36%) was the mouth/mandible (Figure 5), there was a broad distribution of gaff marks in other parts of the body.

Figure 1: Number of fractures sites

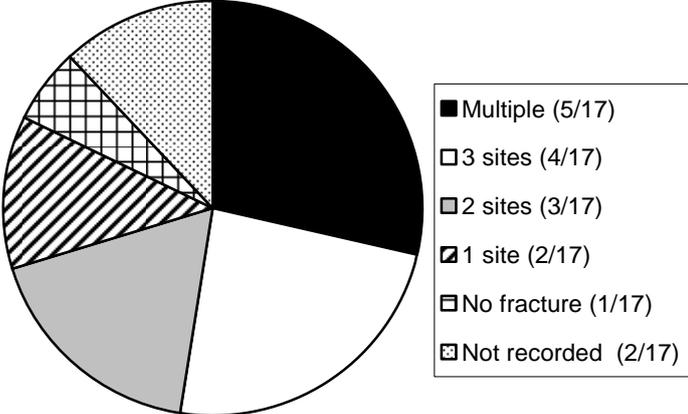


Figure 2: Extent of skull damage

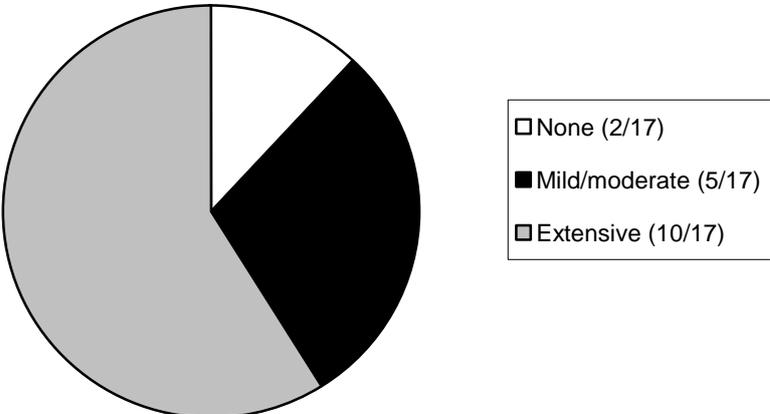


Figure 3: Estimated number of blows

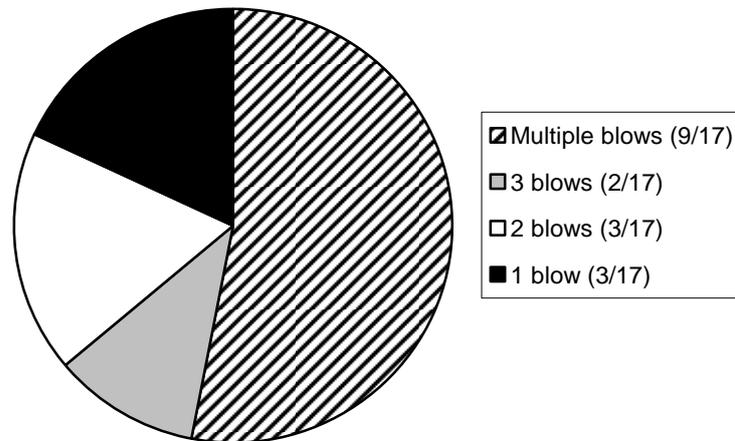
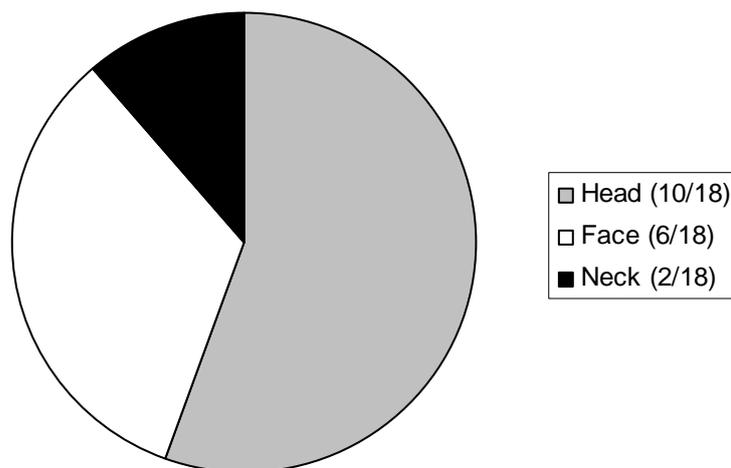
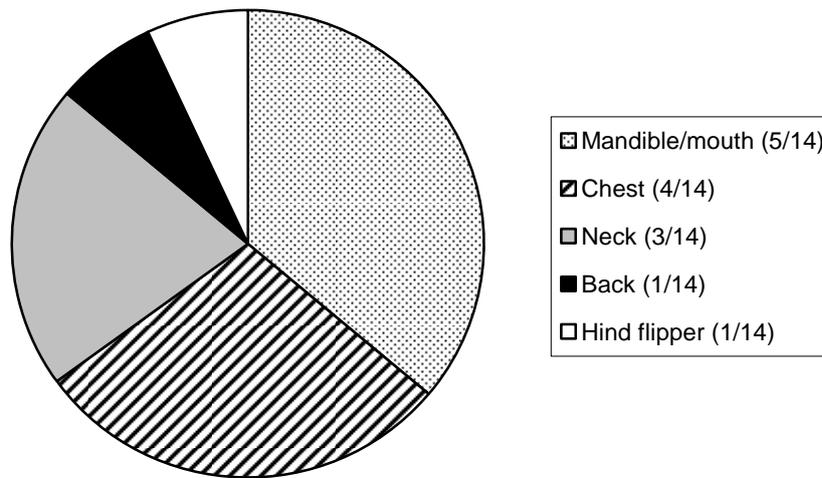


Figure 4: Location of blows



At the end of the *post mortem* examination, each animal was given a welfare score based on three different factors, each of 1 to 10, where 1 indicated that the person who undertook the *post mortem* examination believed that there was no concern about that particular welfare measure, whereas 10 indicated that the person who undertook the *post mortem* believed that there was a significant welfare issue. Most seals were believed to have been dead at the onset of skinning (Figure 6), with a mean (\pm SE) welfare score of 3.7 ± 0.5 . Thus overall, there was general agreement that the seals were, or were likely to have been, dead at the onset of skinning. However,

Figure 5: Location of gaff marks



four seals were scored 6 or higher, and so these may have been alive at the onset of skinning. It must be remembered that these data were collected in 2007, when it was rare for a seal to be skinned soon after clubbing; most seals were stored on the boats, to be skinned later. This probably explains why these *post mortem* data are at variance with the video data collected in years such as 2003, when the seals were often skinned soon after clubbing, either on the ice or on board the boat.

When considering whether the seal was rendered insensible immediately, the distribution of welfare scores was much more variable (Figure 7). There was a bimodal distribution; for 10 seals there was reasonable confidence that the animal was rendered insensible immediately, whereas seven were assessed to have experienced a protracted period to insensibility. The mean welfare score of 4.8 ± 0.6 reflects the lack of confidence that many seals are being rendered insensible immediately.

This conclusion is supported by the assessments as to whether the seal was likely to have suffered any distress following the first insult (Figure 8). There was a broad distribution of these welfare scores, but the mean (5.2 ± 0.6) was higher than the other welfare scores, indicating that the overall pattern was for the seals to suffer distress following the first insult.

Figure 6: Distribution of welfare assessments, from very confident (score of 1) to very unsure (score of 10) that the seal was dead at the onset of skinning

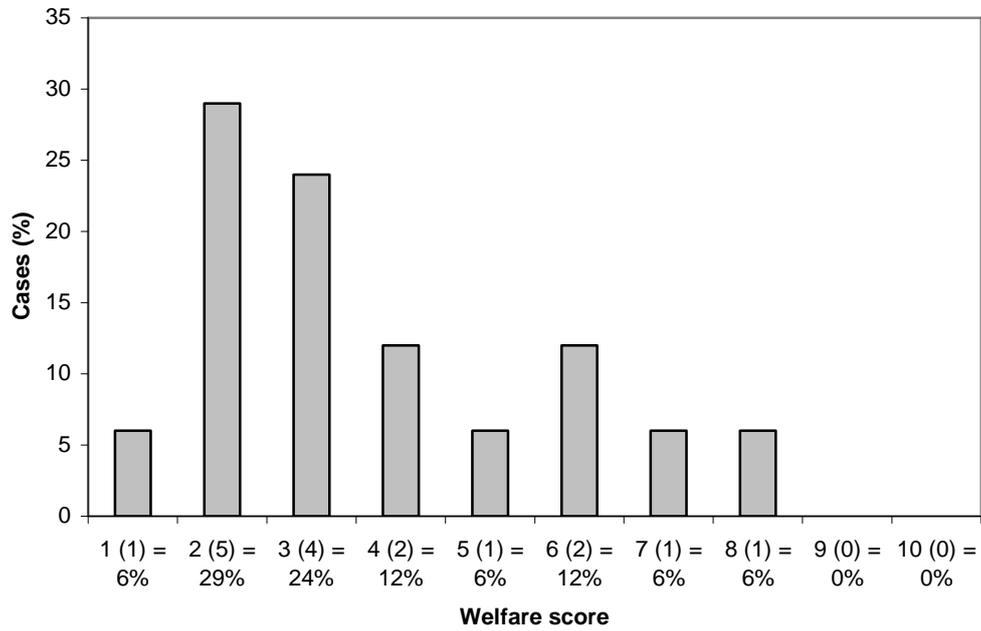


Figure 7: Distribution of welfare assessments, from animal rendered insensible immediately (score of 1) to the animal experiencing a protected period to insensibility (score of 10)

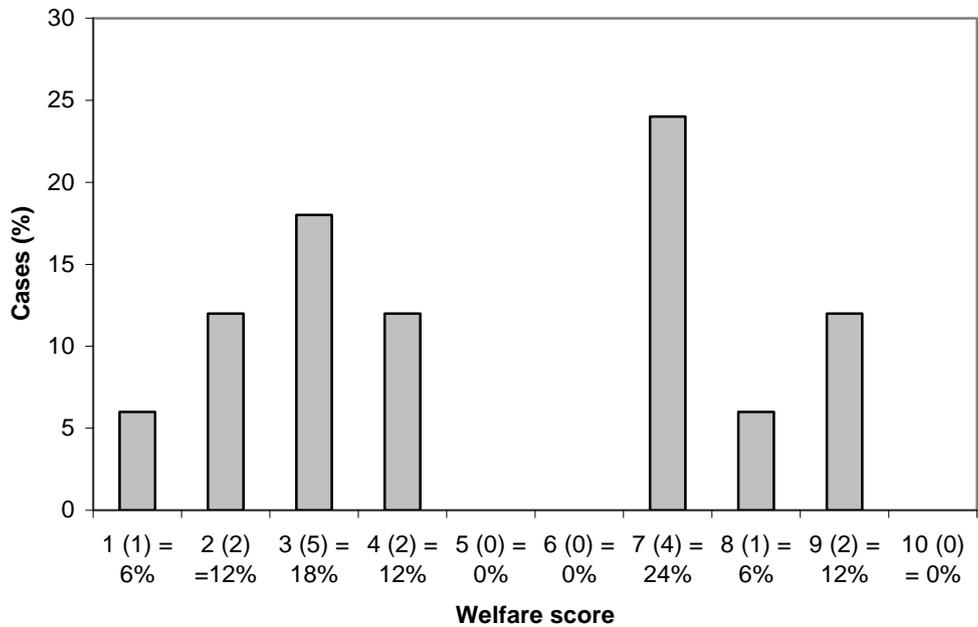
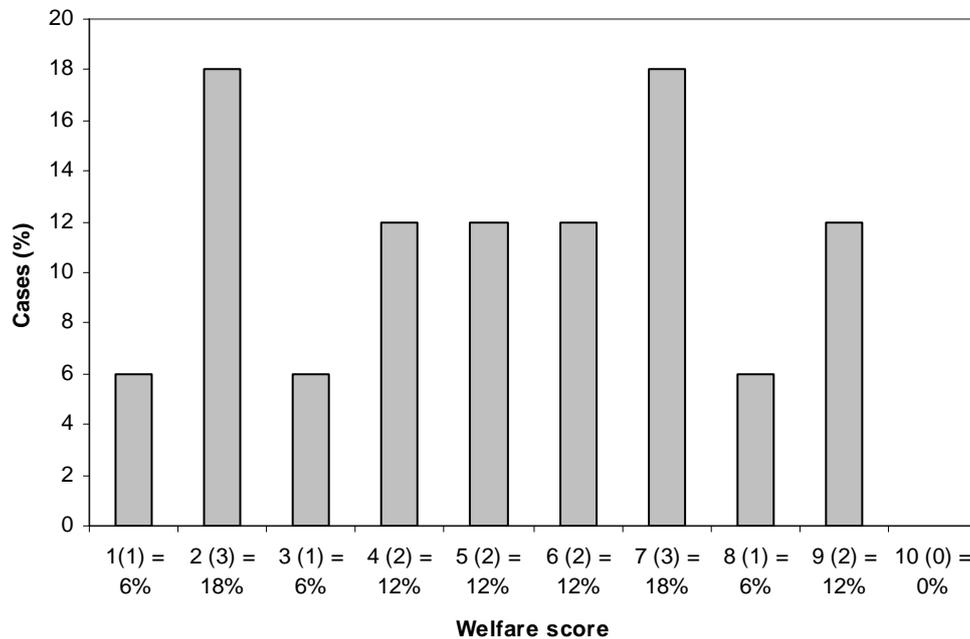


Figure 8: Distribution of welfare assessments, from the animal suffering no distress following the first insult (score of 1) to the animal suffering high levels of distress following the first insult (score of 10)

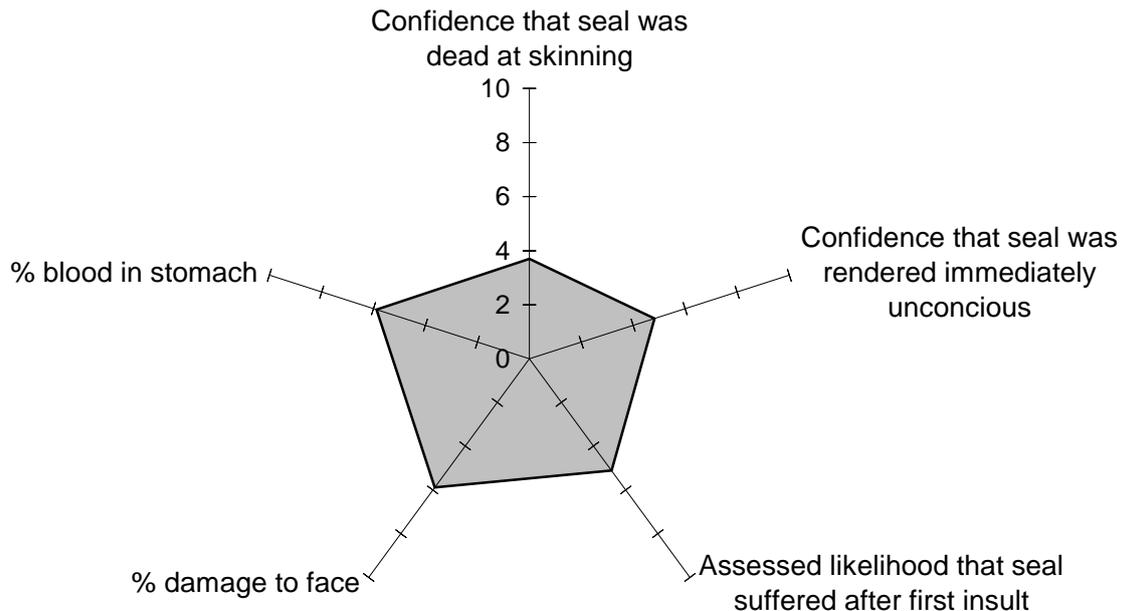


There are two other relevant welfare measures to consider: a significant number of animals (59%) had blood in their un-perforated stomach, indicating that they were alive and swallowing blood after the first insult, and 59% had damage to the face and lower jaw, indicating a poor placement of blows when clubbing the seal. The five welfare measures are summarised in Figure 9: the mean scores are all in the middle range, indicating an overall poor level of welfare for each measure. However, a high score for any one of these measures would indicate a significant welfare concern for that particular seal. Of the seventeen animals examined, only two (12%) had no blood in the stomach, no facial injuries, and all three welfare scores below three. So for only two seals were there no welfare concerns; there were welfare concerns about the way the other fifteen had been killed.

Video data

The number of boats for which video data were collected could not be established in 2003 or 2004. Two different boats were filmed in 2005, three boats in 2006 and

Figure 9: Summary of five welfare measures: (a) % of seals with damage to face and/or lower jaw; (b) % of seals with blood in their stomach; (c) confidence that the seal was dead at the onset of skinning; (d) confidence that the seal was immediately rendered insensible; and (e) confidence that the seal suffered no distress. The shaded area under the plot indicates the likelihood of poor welfare between first insult and skinning



sixteen in 2007, three of which were filmed twice. No boats were filmed in more than one year, and so the video recordings are based on over twenty different vessels and a substantial number of sealers, since several were operating from each boat.

We could determine all or part of the sequences of events for 169 seals. For 88%, we were able to determine the start of the sequence; of these, 37% were shot first, 63% were clubbed first. Seals were often clubbed more than once in quick succession: this was a single bout of clubbing and we use the term "series of blows" to indicate the one event. Of all seals, irrespective of whether they were first shot or clubbed, blinking reflex tests and/or cranial palpation were only undertaken in 33% of cases. These were generally either poorly performed or inadequate, as 23% of seals that were checked still responded to stimuli (19%) or required a further blow(s) with an

implement (4%) some time after a blinking reflex test/cranial palpation was performed. Following the blinking reflex tests and/or cranial palpations, 14% of seals were clubbed again: in only half these cases was the seal rechecked to see if it was then dead.

Fourteen different rifles were filmed being used to shoot seals; at least 8 (57%) had telescopic sights (for four it was unclear, two definitely did not have telescopic sights). In 1/14 cases, the shooting was undertaken by the person steering the boat; in 12/14 cases it was another member of the crew, and in one case it was unclear. Of the seals that were shot, the majority (78%) were shot once. Where two shots were taken, the mean time to the second shot was 8.6 ± 1.6 seconds. Where we could assess the sites of impact (51 shots), 41% were on the head region, 55% were located on other parts of the body such as the back, abdomen or chest, and 4% of shots missed their target. Most shot seals (66%) were subsequently clubbed with a hakapik or club, whilst an additional 16% were responding to stimuli after being shot but were not dispatched with a hakapik or club. Thus, 82% of seals were not killed by the first shot, indicating that this was not an efficient method of killing. The mean duration from first shot to contact by the sealer was 48.8 ± 9.4 seconds, indicating a considerable period of potentially poor welfare.

If those seals that were clubbed, 39% required two separate series of blows. Mean time between series of blows was 23.9 ± 3.2 seconds; this was because sealers were not immediately checking seals and/or were moving on to strike other seals before returning to the first one. This was a consequence of the pattern of hunting. When groups of seals were approached by the sealers, the prime aim was to prevent seals escaping into the water. Sealers often clubbed seals whilst they were running, and the seals were either trying to escape into the sea, or were rearing up in defence; all of these factors prevented accurate placement of blows. The problem was exacerbated because the sealers often slipped whilst running on the ice. Of 180 blows where the site of impact could be determined, 63% were on the head, 21% the face, 6% the neck and 10% the body/back. Furthermore, sealers sometimes struck the seals when holding the hakapik in one hand, thereby reducing the power of the blow and further reducing their accuracy. Thus, 25% of seals (12% received one series of blows, 13% received more than one series of blows) responded to stimuli

after having been clubbed. Most sealers used legal implements to strike seals, predominantly hakapiks (93%) or clubs (4%), but some used illegal implements such as gaffs (3%).

We observed 61% of the seals being gaffed; a large proportion of gaffing incidents were not filmed because the sealers would club many seals and leave them on the ice, returning later to gaff and collect carcasses. From the observed cases, no blinking reflex test or cranial palpation was performed on 79% of the seals prior to gaffing, and 44% responded to stimuli after being gaffed.

Skinning or cutting the seal with a knife was witnessed in only 18 cases. Fourteen (78%) were not checked prior to the onset of cutting/skinning. This was a considerable welfare concern, since 15 (83%) responded to stimulus after cutting had begun; with 6 seals (33%) the sealers stopped cutting to club the seal again. Whilst it was not possible to differentiate unequivocally between conscious responses and unconscious reflex activity, the level of responses shown in some seals were extreme. In the majority of cases, the responses to stimuli occurred at the onset of cutting, and were not a continuation of any movements that occurred prior to the onset of skinning or cutting.

It should be noted that most of these data came from 2003, when the general pattern was for the sealers to skin the seals on the ice soon after they had been clubbed. In other years, seals were left for much longer before being skinned: in 2007, for instance, the seals were generally stock-piled on the boats and few were seen to be skinned. When seals are not skinned straight after being shot or clubbed, it would be expected that far fewer respond to stimuli at skinning, and so the figure of 83% responding to stimuli after cutting had begun is largely based on just one of the five years for which we have video data.

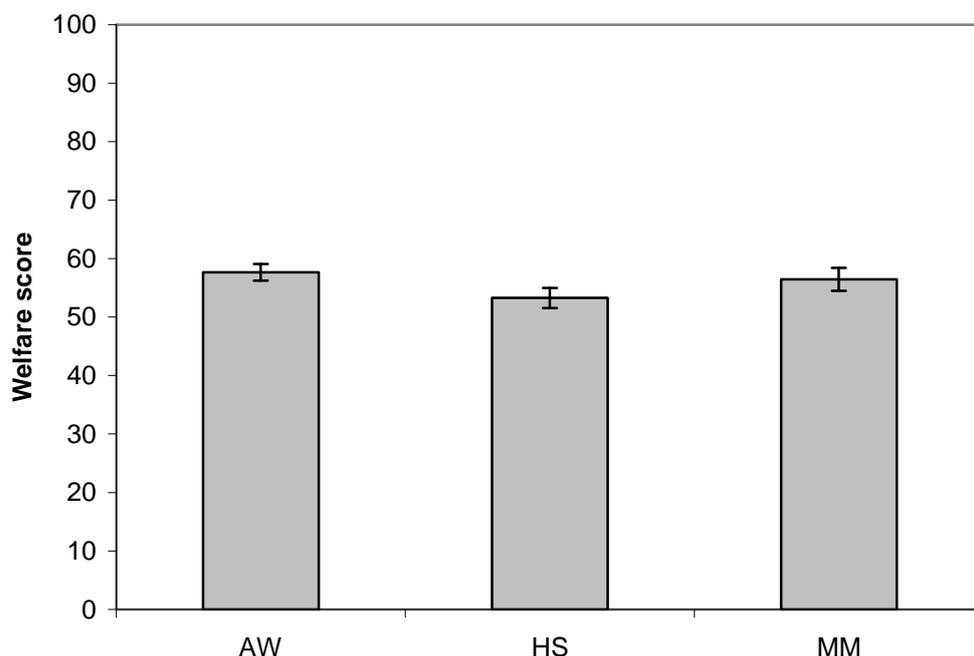
Expert opinion analysis

Fifty-three experts (39.8% of those contacted) responded to the survey: 25 Animal Welfare experts, 15 Humane Slaughter experts and 13 Marine Mammal experts. A total of 1503 timelines were returned (mean (\pm SE) of 15.0 ± 0.4 scores per timeline), with a mean of 28.4 ± 0.4 completed timelines per expert. Animal Welfare experts

assessed 708 timelines (mean 28.3 ± 0.5 ; range 23-30), Humane Slaughter experts 439 timelines (mean 29.3 ± 0.8 ; range 18-30) and Marine Mammal experts 356 timelines (mean 27.4 ± 0.6 ; range 25-30).

With a mean of 56.1 ± 1.0 , the overall welfare score was bad, though there was some variation between experts (Figure 10). The distribution of welfare scores was dichotomous i.e. they were, as might be expected, clustered at either end of the scale (Figure 11). Using the same criteria as applied to the three likelihood scores used to assess the welfare of the seals examined *post mortem* i.e. a score $\leq 30\%$ indicated good welfare, whereas a score of $\geq 70\%$ indicated bad welfare, 33.7% of the submitted scores indicated good welfare, whereas 44.6% indicated bad welfare. When averaging all scores given to each seal, 20% of the timelines had mean values indicating good welfare, whilst 38% had mean values indicating bad welfare.

Figure 10: Mean \pm SE welfare scores of timelines assigned by Animal Welfare (AW), Humane Slaughter (HS) and Marine Mammal experts (MM), where 0=good welfare and 100=bad welfare



The most significant factor that explained variation in scores was the duration of the timeline (Figure 12), with longer duration timelines having higher (i.e. bad) welfare scores. The fitted line suggests that the duration of the timeline is most important for short sequences and that the experts consider that good welfare generally occurs

Figure 11: Distribution of the 1503 welfare scores assigned to 100 timelines, where 0=good welfare and 100=bad welfare

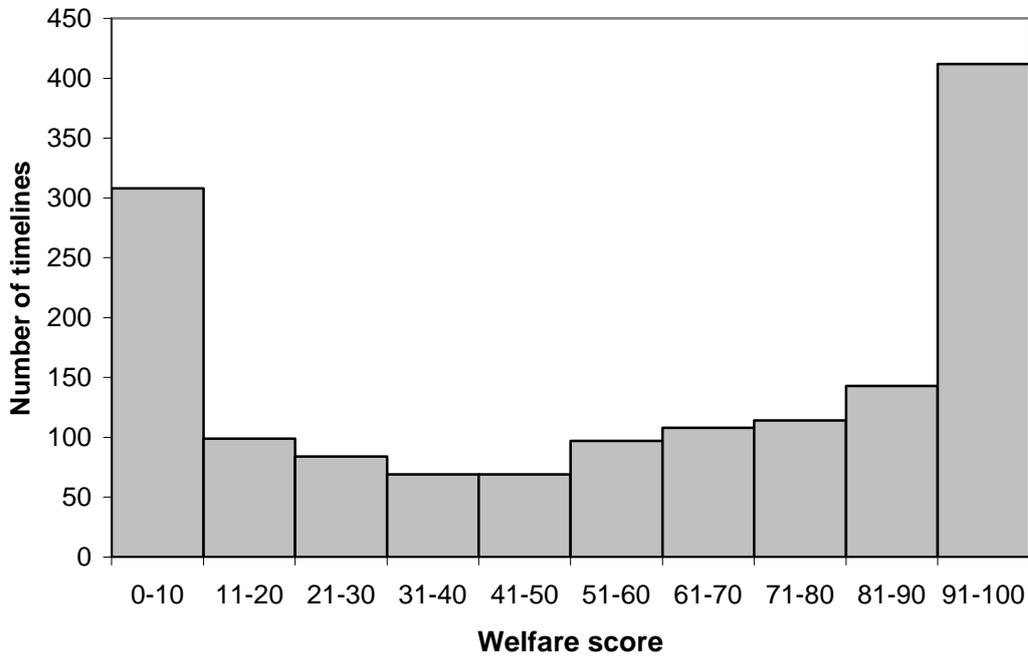
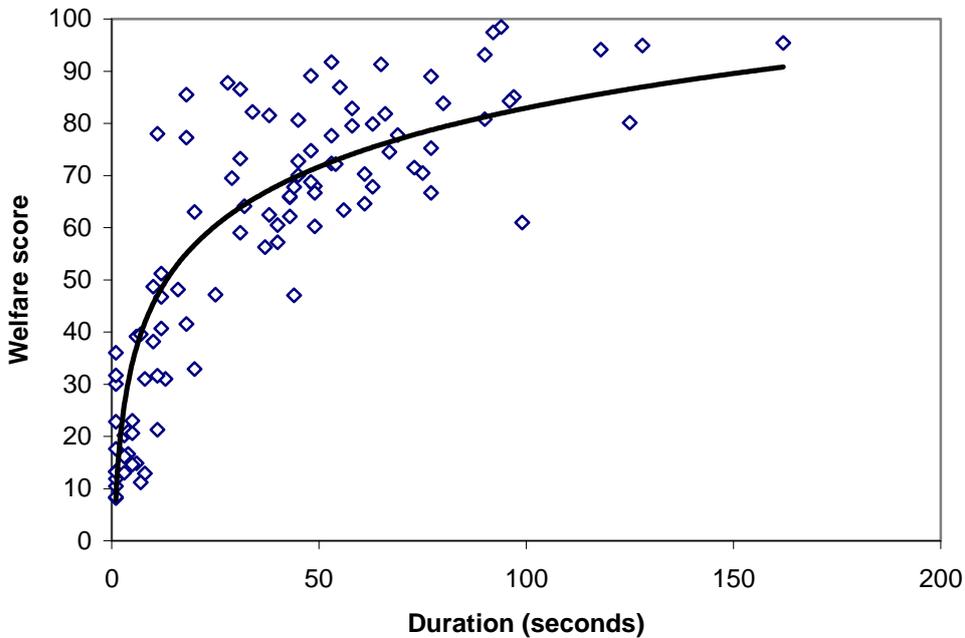


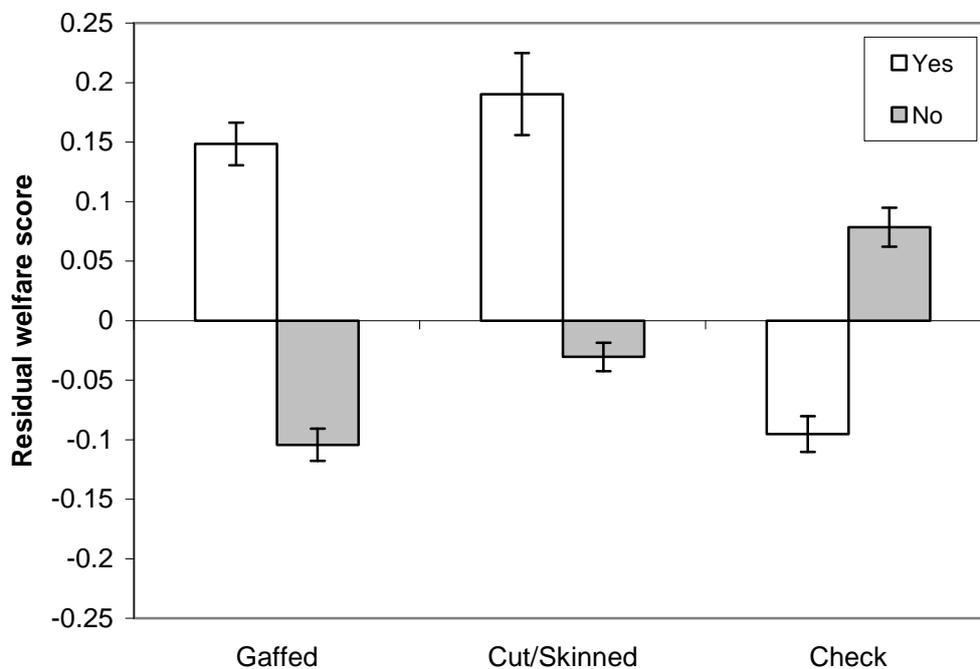
Figure 12: Mean welfare scores for all timelines, where 0=good welfare and 100=bad welfare, with a fitted logarithmic line



when all events occur within ≤ 15 seconds, which was less than 50% of the average duration (38.9 ± 3.4 seconds) of the timelines.

However, some short time sequences also had poorer welfare scores, indicating that the experts also considered other factors to be important. Gaffing before death and cutting/skinning before death both significantly increased (i.e. worsened) the welfare scores, when controlled for duration of the event, whereas checking the seal reduced (i.e. improved) the welfare scores (Figure 13). However, the significance of this variable was lower than the other variables because, in many cases, checking was inadequate and the seal was subsequently gaffed or cut/skinned whilst still sensible (Table 1).

Figure 13: The mean (\pm SE) residual welfare scores for the presence or absence of gaffing whilst sensible, cutting/skinning whilst sensible and checking the seal

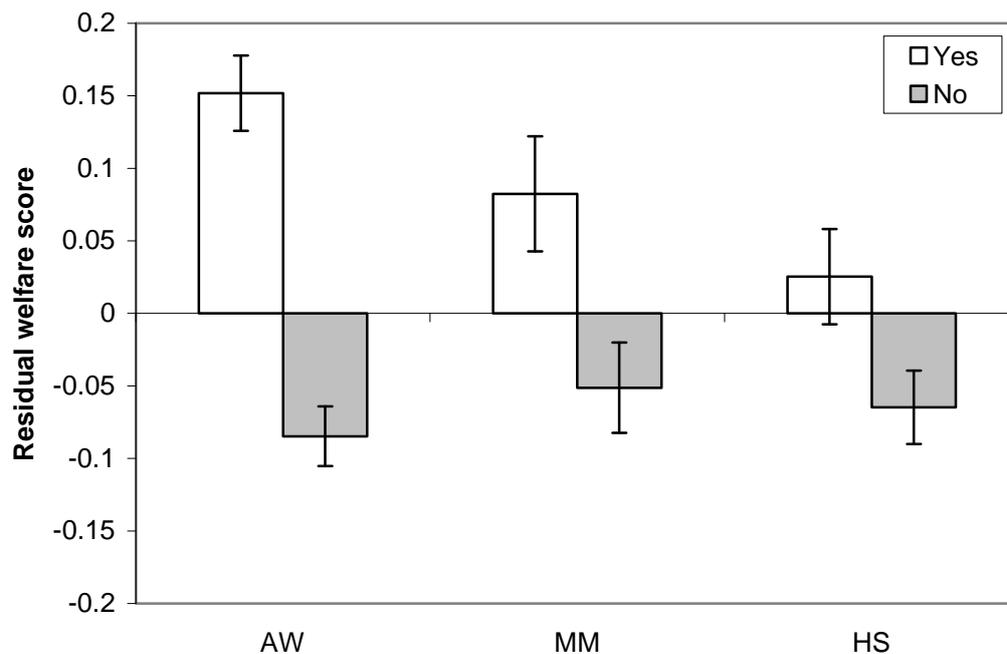


Experts had a relatively minor influence on the model; most variation was caused by variability in scoring gaffing, but not scoring cutting/skinning or whether the seal was checked. Whilst all groups consistently scored welfare as being better where a seal was not gaffed whilst sensible, there was some variability in how each expert group scored this factor, with Humane Slaughter experts scoring gaffing whilst sensible lower (i.e. a better welfare score) than other groups of experts (Figure 14).

Table 1: Results of the generalized nonlinear model showing the variables that significantly influenced the welfare scores allocated to the seal timelines; variables are presented in order of importance to the model. AW = Animal Welfare experts, HS = Humane Slaughter experts, MM = Marine Mammal experts

Variable	Slope \pm SE	t	P
Intercept	0.37 \pm 0.03	11.6	<0.001
Duration	0.01 \pm 0.00	18.2	<0.001
Gaffed	0.27 \pm 0.03	8.4	<0.001
Cutting/skinning	0.36 \pm 0.04	8.0	<0.001
Check	-0.13 \pm 0.03	-4.0	<0.001
Expert*Gaffed			
HS	-0.16 \pm 0.05	-3.1	=0.002
MM	-0.14 \pm 0.05	-2.5	=0.01
AW		0	
Expert			
MM	0.10 \pm 0.05	2.1	=0.03
HS	0.04 \pm 0.04	0.9	=0.39
AW		0	
Expert*Check			
MM	-0.09 \pm 0.05	-1.7	=0.10
HS	-0.04 \pm 0.05	-0.8	=0.42
AW		0	
Expert*Cutting/skinning			
MM	-0.04 \pm 0.08	-0.5	=0.61
HS	0.01 \pm 0.07	0.1	=0.93
AW		0	

Figure 14: The mean (\pm SE) residual welfare score for the presence or absence of gaffing whilst sensible for the different expert groupings



Discussion

Post mortem data

The post-mortem data indicate a considerable lack of confidence that seals are being killed humanely, and the overall welfare scores we compiled are of concern. Whilst it could be argued that our data are based on a relatively small sample size and/or they are atypical since ice conditions were particularly poor in 2007, they are remarkably consistent with the data collected from the 2001 hunt by Burdon *et al.* (2001) and Daoust *et al.* (2002), when ice conditions were much better (Table 2). The striking consistency between the two studies indicates that: (i) welfare standards are not dependent on ice conditions but are of concern whatever the conditions; and (ii) despite Burdon *et al.* (2001) highlighting significant welfare concerns, and the protocols subsequently laid down by the Independent Veterinarians' Working Group (Smith, 2005), there has been no improvement in welfare standards over the last six years. This can only indicate either an inability to improve welfare conditions or a lack of willingness to address welfare concerns.

Table 2: A comparison of different welfare measures between this study, Burdon *et al.* (2001) and Daoust *et al.* (2002); only data from measures that are directly comparable are included

	Burdon <i>et al.</i> (2001)	Daoust <i>et al.</i> (2002)	This study
Did not palpate cranium or undertake blinking reflex test	79%	87%	67%
Time from being shot to first contact by sealer	-	Mean 45.2 (range 12-111) seconds	Mean 48.8±9.4 seconds
% seals that required a second series of blows	40%	-	39%
Time to second series of blows	27 seconds	-	23.9±3.2 seconds
Damage to face/jaw	61% ¹	-	59%
Bled out	6%	-	6%
Extent of cranial fractures	None (17%), minimal-moderate (25%), extensive (58%)	-	None (12%), minimal-moderate (29%), extensive (59%)

¹ Defined as extracranial fractures

Video data

The sequences of events shown in the videos highlighted many welfare concerns. Seals were routinely not checked with a blinking reflex test or cranial palpation to ensure that they were dead. Shooting incapacitated the seal but in the majority of cases did not kill it, even though most sealers were using rifles with telescopic sights.

Even after being clubbed, a large proportion of seals responded to stimuli and a significant proportion were still responding to stimuli at and after being gaffed. Whilst cutting/skinning was rarely observed, in the majority of cases recorded the seal responded to stimuli after cutting had begun, and in a third of cases, the sealer stopped skinning and clubbed the seal again. We have already noted that these figures are largely based on data collected in 2003, and are not representative of all years. Some of the key welfare concerns are summarised in Table 3.

Table 3: Key welfare aspects and percentage of cases showing poor welfare extracted from the videos.

Key welfare aspects	
Checking	67% carried out no checks
Shooting	66% required subsequent blows from implement 16% responding to stimuli but no action taken
Clubbing	39% required second bouts of clubbing 25% showed response to stimuli after clubbing
Gaffing	44% showing response to stimuli at gaffing
Skinning/cutting	83% responding to stimuli at skinning/cutting

The duration of events also gives cause for concern. There was a long time interval between seals being shot and contact being made by the sealer (48.8 ± 9.4 seconds). Where seals were clubbed more than once, there was a significant time interval (23.9 ± 3.2 seconds) between series of blows, during which period the seal might have been sensible or inadequately stunned. Of the 100 sequences where we could time events from the first insult to last action, the mean duration was 38.9 ± 3.4 seconds (range 1-162 seconds). However, these times should be viewed as minima because restrictions caused by filming, such as time limits on the ice or in the air, having to move away from an area where sealers were operating close by, or the helicopter changing position, meant that the video sequences were biased towards short duration events. Filming of longer sequences often ended even though the seal was still responding to stimuli. In fact, for some seals the period during which they were injured was considerable: we viewed cases of injured seals moving and responding to stimuli for up to 34 minutes, in addition to an unknown time from first insult and to an unknown end point.

The legal position and non-statutory recommendations

Whilst the Marine Mammal Regulations stipulate several key requirements for sealers to ensure that seals are killed humanely, even the most basic requirement to prevent poor welfare, checking the seal with a blinking reflex test or cranial palpation, was routinely ignored (Table 4). Furthermore, even where checking occurred, it often appeared to be inadequate, and 23% of seals showed responses to stimuli after checking. This indicates that either sealers were unable to perform/interpret the checks adequately or ignored the signs that the seal was not dead. Only 15% of seals we observed on the videos were killed in a manner that conformed to all the Marine Mammal Regulations; this is a maximum figure, since we did not have continuous sequences for all seals, and so violations could have occurred during the period when events were not being recorded. Since this is the largest marine mammal hunt in the world, with around 300,000 seals killed each year, this low level of adherence to the Marine Mammal Regulations is a major welfare issue.

Table 4: The percentage of cases where there were breaches of some of the Marine Mammal Regulations

Event	% observed events that were contrary to the Marine Mammal Regulations
Seal killed/struck with an illegal implement (n=180) ¹	3% ²
Seal not checked following clubbing and/or shooting (n=169) ³	67%
Seal not checked following a restrike (n=48) ³	92%
Seal not checked prior to cutting/skinning (n=18) ³	78%

¹ This is the total number of events, since in some cases the same seal was clubbed with both a gaff and hakapik/club in separate events; an event consists of a series of one or more blows carried out within a short period of time

² Guns/rifles were not assessed, since it was not possible to determine calibre of the weapon or the type of ammunition from videos

³ This is all the seals were scored for this event; 14% were checked first and then clubbed again, the majority were not checked the first time

The Marine Mammal Regulations stipulate that no person shall attempt to kill a marine mammal except in a manner that is designed to kill it quickly. The mean duration of events documented here show that this regulation was being broken routinely. Furthermore, Section 446 of the Criminal Code of Canada says anyone commits an offence who “wilfully causes or, being the owner, wilfully permits to be

caused unnecessary pain, suffering or injury to an animal or bird". The protracted time scale of events recorded in this study, the failure to check that a seal was dead, the long periods that elapsed before a sealer checked whether an animal was dead, and the failure to respond to signs that a seal was sensible, could all be considered as wilfully permitting unnecessary pain, suffering or injury to be caused to a seal.

It goes without saying that the non-statutory recommendations were also being ignored. Of 169 seals, we saw no cases where the three-step process recommended by the Independent Veterinarians' Working Group (stunning, checking, and bleeding, to be carried out in sequence as rapidly as possible) was carried out, and have already commented on the protracted periods between recorded events. The Independent Veterinarians' Working Group also recommended that competition and haste in the hunt should be reduced; however, haste and non-compliance are inevitable since practical and commercial considerations ensure that the prime aim of the sealers is to prevent the escape of as many seals as possible.

Similarly, whilst the *Handbook for Sealers* produced by the Carino Company Ltd. may state that seals should only be shot in the head, this is an impractical recommendation, since it is impossible to achieve high levels of accuracy when shooting from a boat, even when using telescopic sights. Even in a calm sea, the boat is moving, the ice is moving, and the seal may also be moving. These problems are exacerbated when sea and/or wind conditions are not calm. Only a minority of shot seals were killed humanely; the majority were wounded, but the sealers were reluctant to shoot the seal a second time because it reduced the value of the pelt, and there was a protracted period before the sealer reached the seal.

Expert opinion analysis

Since there is considerable debate about the welfare aspects of the Canadian commercial seal hunt, we contacted a wide range of international experts to ask their views on the overall welfare of 30 seals during the processes which resulted in their death, based on summary timelines that identified when key events occurred. There are potential problems with undertaking expert opinion analyses, most fundamentally determining who is a relevant expert. We drew experts from three fields of expertise

(Animal Welfare, Humane Slaughter of both captive and wild animals, and Marine Mammals) based on our own knowledge of people working in these three areas, and by searching recent published literature. There was no pre-selection based on views, and we tried to include as wide a range of experts as possible. Whilst some people declined to respond because they felt they were not qualified to comment or because they were part of the European Food Safety Authority's Working Group looking into this issue, and a significant number of people were on vacation, the response rate for this sort of exercise (39.8%) was good, and we obtained returns from a range of experts. Furthermore, the consistency of scoring between groups of experts, and the relatively minor influence of expert type on the model, suggest that there was no bias in the results due to expert selection. Thus we believe that the data presented here provide an objective overview of the opinion of international experts on the welfare of harp seals during the commercial Canadian hunt.

We accept that the timelines we sent the expert panel were a simplified summary of events; this was partly of necessity due to time constraints and partly to maximise response rates. However, simplified timelines have the advantage that they focus on key welfare issues and facilitate analysis of the factors on which people base their opinion. The key factor was the duration of events, and timelines ≤ 15 seconds were given a mean welfare score that indicated good welfare; however, this was below the average, and 70% of timelines were longer than 15 seconds. Furthermore, the timelines were biased towards short duration events, and so this underestimates the proportion of culling events that were longer than 15 seconds.

It may well be that not supplying information on the number of blows that a seal received, or where the blows landed, or where each seal was shot, affected the welfare scores given to each seal. Furthermore, showing timelines in isolation does not give any information on the competitive nature of the seal hunt, nor do timelines show when checking the seal and/or clubbing it again were not undertaken at the first available opportunity. Any bias is likely to be towards a lower (i.e. better) welfare score, and this should be borne in mind when interpreting these scores. However, any bias may not have had a significant impact on the overall pattern of scoring; a key feature of the analyses was the dichotomous distribution of scores. This was because the welfare of most seals was scored as generally "good" or "bad"; only

21.7% of scores were in the middle of the range. Considering the factors which experts viewed as important when allocating their scores, it is unlikely that supplying more detailed information would have had a significant impact on whether an expert placed an individual seal in one category or another. Furthermore, there was a striking similarity between the mean welfare scores given by the three experts who examined the seal pups *post mortem* (5.2 ± 0.6 , scale 0-10) and the mean welfare scores for the timelines examined by the panel of international experts (56.1 ± 1.0 , scale 0-100). Thus using different approaches and different groups of experts to assess the welfare of the commercial Canadian seal hunt led to very similar outcomes, and we believe that the conclusions presented here are robust and reflect the views of a wider scientific community.

International slaughter standards

When animals are slaughtered for meat consumption, the expectation is that they are rendered insensible without inflicting pain or undue distress, and that they remain unconscious to the time that they die. Recommendations and regulations in both Canada and the European Union are designed to ensure that these expectations are met: specific standards aim at:-

- Minimising distress during restraint and during application of the stunning equipment;
- Inducing unconsciousness painlessly and without the need to repeat the application of the stunning method; and
- Ensuring that the animal remains unconscious.

The first expectation is hard to achieve in the Canadian seal hunt and it would be impossible to avoid some period of distress prior to clubbing. The seals showed distress in the period immediately prior to being clubbed, particularly when they tried to escape or showed defensive responses such as rearing up and trying to bite at the sealer and/or hakapik. Whilst these were generally relatively short-term events, the seals were clearly showing fear prior to being clubbed, and this is of concern.

The methods used in hunting seal pups fall short of the second expectation because significant numbers of seal pups have to be shot or struck more than once, and because insufficient care is taken to ensure that each animal is rendered insensible before the operator performs another task or the same task on another animal. The standard in providing a single effective shot or strike in despatching seal pups is well below the corresponding standard achieved for animals in slaughterhouses. It might be argued that the two situations are not comparable and that this justifies different standards. That view, however, needs to take into account the necessity to perform the hunt, and the scale of inevitable suffering. If few animals are affected, then there may be greater tolerance of suffering. Since the number of affected animals in the Canadian seal hunt is large and the wounding is severe and/or the period of distress is protracted, the method of hunting must be considered unacceptable.

The third expectation is also of concern. The recommended interval between stunning and sticking in slaughterhouses is short because many of the stunning methods are reversible. Hence the recommendation is to bleed an animal within 60 seconds of applying a concussion stun to limit the risk of the animal returning to consciousness. Despite the three-step process recommended by the Independent Veterinarian's Welfare Group (stunning, checking by palpation of the skull and bleeding, to be carried out in sequence as rapidly as possible), we saw no cases where this process was carried out. Whilst they could not be included in the analyses, because we had no data on the start or end of the sequence, some of the video sequences showed seals that had been clubbed, but were clearly conscious, crawling around the ice and, in some cases, reaching the sea. The longest incomplete sequence lasted 34 minutes; whether any of these animals had been rendered unconscious initially and then regained consciousness is unknown, but they were conscious, and in distress, for extended periods of time. It was also clear from the videos that at least some of these seals had been struck on the muzzle, not the cranium, and had extensive damage to the muzzle. This clearly reflects the poor placement of blows. However, practical restrictions on filming the hunt meant that we could not determine how frequently wounded seals were conscious for extended periods of time.

Conclusions

- This analysis of seal carcasses collected in 2007 and video tape evidence randomly collected over five years (2003 to 2007) with very different ice conditions and from a variety of different sealing boats has enabled a comprehensive overview of the welfare issues associated with the commercial Canadian seal hunt as it currently operates.
- There are considerable welfare concerns about how the hunt is conducted, and these are consistent between years i.e. there is no evidence that poorer welfare is associated with poor ice conditions or other factors that make the hunt harder to conduct, although different welfare issues assumed greater prominence in particular years. These welfare concerns are also consistent between different groups of people analysing different sets of data.
- When ice conditions were poor, most seals were shot. Wounding rates were high, and only a minority of seals were killed with the first shot. Even when a seal was obviously wounded and struggling on the ice, sealers were reluctant to shoot the seal again unless it was moving to the edge of the ice and appeared likely to escape. This was because additional bullet holes would reduce the value of the pelt, and the consistency of the behaviour seen in the videos made it clear that the value of the pelt took priority over dealing with a wounded seal. As a consequence, some seals were observed to be "struck and lost" because a sealer did not shoot the seal a second time. However, it was not possible to provide a quantified estimate of the percentage of seals "struck and lost" because there were relatively few complete continuous events on the videos.
- It is unclear from the videos whether the high level of wounding of shot seals was due to using inappropriate weapons and/or ammunition, lack of skill/training of the sealers, or the difficulties of trying to shoot from a boat. However, it is most probable that, even with appropriate/better weapons and training, wounding rates would be unacceptably high as a result of trying to shoot from a moving boat. Even with relatively calm sea conditions, accurate

placement of a shot, in the relatively small brain area, is difficult, because the boat is moving, the ice is moving, and the seal may also be moving. The problems were exacerbated when sea and/or wind conditions were not calm, and when the seals were lying on their back or sides, or were obscured by ice. Since it is impossible to ensure a high level of accuracy when shooting from a boat, even when using telescopic sights, hunting seals with rifles should be viewed as inherently inhumane and it is highly improbable that any improvements would lead to internationally acceptable standards of welfare.

- There are considerable welfare concerns when sealers are able to use clubbing as the primary means of killing seals. Wounding rates were high, seals were clubbed in a variety of places other than the head, the timing of events was protracted, with sealers chasing and clubbing as many seals as possible before they escaped to the sea (the "gold-rush" effect). The majority of seals were not checked to see if they were dead, and those checks that did take place often appeared to be perfunctory and clearly "token", without the sealer even watching to see whether the seal responded to a blinking reflex test.
- However, it is likely to be very difficult to improve the welfare issues associated with clubbing seals. When sealers move onto the ice, there is considerable pressure to prevent seals escaping, and so their normal practice is to club as many seals as possible, as quickly as possible before they escape into the sea, without checking whether each seal is actually dead. We never observed the three-step process of stunning, checking (palpation of the skull) and bleeding, carried out in sequence as rapidly as possible, that is recommended by the Independent Veterinarians' Working Group (Smith, 2005). This is inevitable: since the hunt involves killing large numbers of seals in just a few days, the pressure is on sealers to minimise the time spent processing each seal. These commercial and practical considerations conspire to make the clubbing of seals inherently inhumane and we believe that it is unlikely to be possible to improve standards such that this method of killing would reach internationally acceptable standards of welfare.

- There was evidence of widespread disregard for the Marine Mammal Regulations and non-statutory regulations published by the sealers' professional bodies. This in itself is a major welfare issue, and the fact that exactly the same concerns, with almost identical levels of frequency, were recorded in 2001 and 2007 indicates a lack of willingness, or inability, to improve the welfare issues associated with the commercial seal hunt in Canada. These data also indicate a failure by the Canadian Department of Fisheries and Oceans to monitor the hunt effectively and/or enforce the Marine Mammal Regulations.
- The expert opinion analysis was in remarkably close agreement with the results generated by the *post mortem* analyses and the analyses of the seal timelines, suggesting that the data presented here are robust. Furthermore, the consistency of the results from the three groups of international experts suggests that the expert opinion analysis provided an objective overview of the wider scientific opinion on the welfare aspects of the Canadian commercial seal hunt.
- EU and Canadian welfare standards in slaughterhouses require that unconsciousness is induced painlessly and without the need to repeat the application of the stunning method. The methods of hunting seals in Canada fall short of this expectation, and the large number of animals involved each year means that this method of hunting should be considered unacceptable.

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Appendix 1: Summary of *post mortem* data collected from 17 seal carcasses

1. Length (cm)	Average 84.9 cm
2. Sex M/F	11 males, 6 females
3. Bleeding on incision wounds	Yes: 0/17 - 0%
4. Ocular trauma?	Yes: 14/17 - 82%
5. <i>Pre mortem</i> bleeding in mouth and nostrils?	Yes: 10/17 - 59%
6. Is the skull fractured?	Yes: 14/16 - 88%
7. How many skull fracture sites?	Multiple: 5/17 - 29% 3 sites: 4/17 - 24% 2 sites: 3/17 - 18% 1 site: 2/17 - 12% No fracture: 1/17 - 6% Not recorded: 2/17 - 12%
8. Extent of skull damage?	None: 2/17 - 12% Mild/moderate: 5/17 - 29% Extensive: 10/17 - 59%
9. Damage to jaw/face?	Facial damage: 10/17 - 59%
10. Was the animal bled out?	No: 16/17 - 94% Yes: 1/17 - 6%
11. Bullet wounds?	Yes: 1/17 - 6%
12. Was the seal clubbed?	Yes: 17/17 - 100%
13. Estimate number of blows?	Multiple blows: 9/17 - 53% 3 blows: 2/17 - 12% 2 blows: 3/17 - 18% 1 blow: 3/17 - 18%
14. Site(s) of blows?	Head: 10/18 - 56% Face: 6/18 - 33% Neck: 2/18 - 11% (More than one site possible)
15. Dislocation of the atlanto-occipital axis?	No: 17/17 - 100%
16. Gaff wounds present?	Yes: 12/17 - 71%
17. Gaff wound site(s)?	Mandible/mouth: 5/14 - 36% Chest: 4/14 - 29% Neck: 3/14 - 21% Back: 1/14 - 7% Hind flipper: 1/14 - 7% (More than one site possible)

Cont.

Appendix 1: cont.

18. Total brain volume destroyed (%)?	None: 3/17 - 18%	
	0-5%: 2/17 - 12%	
	5-10%: 2/17 - 12%	
	>10%: 8/17 - 47%	
	Total destruction: 2/17 - 12%	
19. Frothy blood in the trachea?	Yes: 7/17 - 41%	
20. Frothy blood in the lungs?	Yes : 5/17 - 29%	
21. Body cavity intact at time of <i>post mortem</i> ?	No: 17/17 - all animals cut open during skinning	
22. Free blood in the abdomen?	Yes: 3/17 - 18%	
23. Viscera colour?	Dark: 0/17 - 0%	
	Normal: 4/17 - 24%	
	Pale: 11/17 - 65%	
	Very pale: 2/17 - 12%	
24. Contents of stomach?	Nothing: 6/17 - 35%	
	Food: 1/17 - 6%	
	Blood: 10/17 - 59%	
25. Contents of small intestine?	Nothing: 11/16 - 69%	
	Digested food: 5/16 - 31%	
26. Determination of the method of death	Clubbed head: 13/17 - 76%	
	Clubbed neck: 3/17 - 18%	
	Clubbed face: 5/17 - 29%	
	Shot then clubbed: 1/17 - 6%	
	(More than one site possible)	
27. How confident are you that the animal was dead at the time of skinning?, where 0=very confident, 10=very unsure	1: 1/17 - 6%	6: 2/17 - 12%
	2: 5/17 - 29%	7: 1/17 - 6%
	3: 4/17 - 24%	8: 1/17 - 6%
	4: 2/17 - 12%	9: 0/17 - 0%
	5: 1/17 - 6%	10: 0/17 - 0%
28. In your opinion, was the animal rendered insensible immediately?, where 0=immediately, 10=protracted period to insensibility	1: 1/17 - 6%	6: 0/17 - 0%
	2: 2/17 - 12%	7: 4/17 - 24%
	3: 5/17 - 29%	8: 1/17 - 6%
	4: 2/17 - 12%	9: 2/17 - 12%
	5: 0/17 - 0%	10: 0/17 - 0%
29. Do you think that the animal suffered distress following the first insult?, where 0=no distress, 10=high levels of distress	1: 1/17 - 6%	6: 2/17 - 12%
	2: 3/17 - 18%	7: 3/17 - 18%
	3: 1/17 - 6%	8: 1/17 - 6%
	4: 2/17 - 12%	9: 2/17 - 12%
	5: 2/17 - 12%	10: 0/17 - 0%