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Norwegian Scientific Committee for Food Safety

Opinion of the Panel on Animal Health and Welfare of the Norwegian Scientific Committee for Food Safety
8.10.07

Scientific Opinion on animal welfare aspects of the killing and skinning in the Norwegian seal hunt

SUMMARY

In connection with the preparation of a scientific opinion on the animal welfare aspects of methods for killing and skinning seals currently being used in EU and non-EU countries, the European Food Safety Authority (EFSA) has asked for data on the animal welfare aspects of the methods currently being used for killing and skinning seals.

The Norwegian Scientific Committee for Food safety, VKM, (panel on Animal Health and Welfare) has offered to provide information. This opinion on animal welfare aspects of the killing and skinning in the Norwegian seal hunt contains the information requested by EFSA.

To prepare the scientific background documents necessary to answer the questions, VKM, Panel on Animal Health and Welfare, established an *ad hoc* group consisting of 5 national experts.

Norwegians have from way back been hunting marine mammals. Several species of seal are hunted, and Norwegian regulations clearly state that no hunt should be permitted unless sufficient knowledge is available about the status and abundance of the actual stock. The main target species is the harp seal, which is hunted in the Greenland Sea and the Barents Sea. The recent removals by Norway have varied between 20000 and 25000 animals. All hunting of hooded seals was prohibited from the 2007 hunting-season on due to uncertainties concerning stock size. About 1000 grey and harbour seals are harvested each year along the Norwegian coast and a few hundreds of ringed seals and bearded seals at Spitsbergen.

Seals in general have a large and impressive capacity to stay submerged for extended periods of time. Additionally, since seals are adapted to life in ice-cold water, their (peripheral) tissues are very tolerant to cold and may therefore remain functional even after being exposed to low air temperatures in connection with skinning.

These features may enable the skeletal muscles and the heart of seals to continue to contract long after the animal has been killed. A continued contraction of the heart might also cause other tissues to maintain a certain level of function for many minutes after killing, unless the animal is properly bled.

The killing of un-weaned pups is prohibited. This has led to increased use of the rifle and less use of the hakapik/slagkrok (hand-held striking weapon) as the preferred weapon for the initial stunning, since weaned pups typically are more alert and mobile than un-weaned and tend to escape into water when approached by man. Also, because all hunting of hooded seals was prohibited, current regulations for hunting of ice-breeding seals in effect only apply to the hunt of harp seals. The regulations state that the killing of adult harp seals (of both sexes) in the breeding lairs is prohibited.

Today almost all seals hunted are shot. For all animals over one year (1+) approved rifles and expanding bullets are mandatory as first weapons. Seals are shot through the head. Hakapik used as first weapon is not regarded to be a suitable method for the stunning or killing of seals over one year. When hakapik is used as first weapon (pups), two blows are mandatory and both are directed to the skull over the brain. The first blow is given with the blunt projection of the tool, and the second blow with the spike. The first blow is to cause concussion and loss of consciousness by multiple fractures, crushing of the skull roof and brain damage and fractures in the skull base. The spike is used to ensure the persistence of the state of irreversible unconsciousness by bringing about further damages and haemorrhages in the brain structures as the spike penetrates deep into the cerebrum and the basis of the brain. The sharp part of the hakapik, the spike, is, however, prescribed used after all seals, pups included, have been shot with the rifle.

A limited number of studies are available on how effective rifles are with relation to killing effort. However, a study of 349 weaned harp seal pups shot with rifle in the Norwegian hunt showed that 98 % of the seals had been rendered instantly or very rapidly unconscious or dead.

Weaned pups are permitted stunned using hakapik/slagkrok.

Data on stunning of seals with the hakapik used in the Norwegian hunt are very limited. One study on the stunning/killing ability of hakapik used under controlled condition showed that a single blow to the head of three conscious young hooded seals with the blunt part of slagkrok produced immediate and irreversible disappearance of brain activity, as recorded by electroencephalogram. This is equivalent to what has been described when stunning cattle with the captive bolt pistol and the study concluded that a blow to the head with the slagkrok represented an effective method of killing young seals, and that there is no connection between conscious life and post mortem muscle activity.

The seals are bled on the ice immediately after they have been shot and struck with the spike of the hakapik by cutting the *Arteria brachialis* in the armpits on both sides. After cutting of the arteries the blood pressure rapidly drops, as indicated by cessation of pulsatile flow within 10-15 seconds.

The conclusion of the panel is that available scientific data show that the ammunition used in the hunt of harp seal pups is highly effective in causing instantaneous unconsciousness and death by means of destructive brain damage. The current data from the Norwegian hunt of pups with rifle indicate high killing efficiency. Similar data are not available from the Norwegian hunt of 1+ animals. However, the fact that more powerful ammunition is used and the target area is larger in 1+ animals, it is likely that killing efficiency is comparable with that reported for pups. In order to provide scientific data, further investigations are needed on the effects of the currently used ammunition and potential alternatives.

The scientific data on the efficiency of the Norwegian hakapik are limited. Nevertheless, based on data obtained in experiments, comparative studies and experience, it is the opinion

of the panel that the hakapik is highly effective in causing instantaneous unconsciousness and death of seal pups. The fact that the hunter is close to the animal contributes to a rapid kill. However, the restricted availability of data requires that further studies should be performed on the effect of the hakapik as currently used in the Norwegian hunt.

Current bleeding practice results in rapid blood loss and is an effective method in the field.

During hunting of wild terrestrial animals, the stun/kill and bleeding out will, as a rule and normally, be carried out in one and the same operation, using weapons or projectiles which damage the central nervous system, the lungs and/or the circulation. In contrast, the prescribed method for killing domestic mammals is a two-step operation, with the stunning procedure being followed by bleeding out by opening the main vessels to the brain or from the heart.The three-step killing method required for 1+ seals (shooting, hakapik, bleeding) is a highly efficient and very thorough practice of stunning and killing a mammal. Hence, this practice in the Norwegian seal hunt should be regarded much more conservative than the current practice in other wildlife hunts as well as in some methods used in the slaughterhouse industry.

When these methods are correctly applied in the seal hunt, it is the opinion of the *ad hoc* group and the panel that it is highly unlikely that the animal should remain conscious and alive when skinning starts.

Current practice, which requires training programs for sealers prior to the hunt, contributes to correct performance. Also, the presence of official inspectors surveying the seal hunt in the field, and who provide the Authorities with annual reports, contributes significantly to best practice.

Based on the available documentation, the Panel of Animal Health and Welfare supports the conclusion of the *ad hoc* group. However, scientific, peer-reviewed studies and scientific data on the actual performance of the Norwegian seal hunt are very limited. Research is necessary in order to fully assess the welfare aspects of the Norwegian seal hunt.

CONTRIBUTORS

Persons working for VKM, either as appointed members of the Committee or as *ad hoc* experts, do this by virtue of their scientific expertise, not as representatives for his/her employers. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

ACKNOWLEDGMENTS

The Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM) has appointed an *ad hoc* group consisting of both VKM members and external experts to answer the request from the European Food Safety Authority (EFSA). The report from the *ad hoc* group has been discussed and approved by the VKM's Scientific Panel on Animal Health and Welfare.

VKM, Panel on Animal Health and Welfare, wishes to acknowledge all the members of the *ad hoc* group for their valuable work with the draft report. The panel wishes, in particular, to thank Egil Ole Øen for chairing the *ad hoc* group.

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CONTENTS

GLOSSARY

Aerobic metabolism: Oxygen-dependent metabolism

Anaerobic metabolism: Oxygen-independent metabolism

Beater: Older (more than 2-3 weeks) harp seal pup, weaned, white fur moulted

Blueback: Hooded seal pup

Captive bolt (pistol): Stunning instrument with a retractable metal bolt that penetrates the brain. Commonly used for slaughter of domestic animals.

Cardiac output: The amount of blood that is pumped by the heart in one minute (ml/min)

EFSA: the European Food Safety Authority

Hakapik: Stunning instrument with hammer and a spike that penetrates into the brain
Commonly used for the stunning and killing of seal pups

Hypoxia: Lack of oxygen

ICES: International Council for the Exploration of the Sea

NAFO: Northwest Atlantic Fishery Organization

NAMMCO: North Atlantic Marine Mammal Commission. Inter-governmental organisation for the management of seals and whales

Slagkrok: A modified hakapik used to stun seal pups

Soft-point bullets: A type of firearm bullet that expand into a mushroom-like shape on penetration of a body

TAC: Total allowable catch

Whitecoat: Young (0-14 days) harp seal pup with soft, white lanugo fur, suckling until the age of 12 days

1+ seal: Seal that is one year old or older

BACKGROUND

The European Commission has asked EFSA for a scientific opinion on the animal welfare aspects of methods for killing and skinning seals currently being used in EU and non-EU countries. EFSA has also been asked to assess the most appropriate killing methods for seals that will prevent or reduce any unnecessary pain, distress and suffering.

EFSA will limit its opinion to the scientific aspects of animal health and welfare issues related to the killing and skinning of seals, as the Authority's legal mandate does not include socio-economic, cultural or ethical aspects of animal welfare.

In occasion of the Advisory Forum meeting of 19 April 2007 the European Food Safety Authority (EFSA) asked for data from EU Member States and Observer Countries on the animal welfare aspects of the methods currently used for killing and skinning seals.

The Norwegian Scientific Committee for Food Safety, VKM, (Panel on Animal Health and Welfare) has offered to assist and to provide information including: data on number of animals killed, methods used, misses and reasons for misses, timing from shooting to stunning, to bleed out , to skinning and/or carcass dressing. Additionally, data have been requested on how long it takes for the animals to become irreversibly unconscious, together with a description of killing methods and data on bleeding time.

To prepare the scientific background documents necessary to answer the questions, the Norwegian Scientific Committee for Food Safety, Panel on Animal Health and Welfare, established an *ad hoc* group consisting of 6 national experts. The group was chaired by Dr. Egil Ole Øen. The other members of the *ad hoc* group were:
Professor Bjarne O. Braastad, Professor Lars Folkow, Professor Tore Haug and Dr. Siri Knudsen. Professor Jon M. Arnemo was also appointed in the group but was unfortunately not able to contribute to the *ad hoc* group. The *ad hoc* group has had one all-day meeting and one 2-day meeting.

The VKM Panel on Animal Health and Welfare discussed a preliminary version of the report in a meeting on the 28th of August. The full report from the *ad hoc* group was discussed electronically and approved by the VKM's Scientific Panel on Animal Health and Welfare the 12th of September.

TERMS OF REFERENCE

The European Commission has asked the European Food Safety Authority (EFSA) to issue a scientific opinion on:

1. The animal welfare aspects of the methods currently being used , particularly non-traditional methods, for killing and skinning seals in respective range states and,

2. In addition, to assess, on the basis of current scientific knowledge including other available information on different killing and skinning practices, the most appropriate/suitable killing methods for seals which reduce as much as possible unnecessary pain, distress and suffering.

EFSA has asked for data from member states and observer countries at the Advisory Forum meeting in Berlin 19th on April 2007.

The Norwegian Scientific Committee for Food Safety, Panel on Animal Health and Welfare, on communication with EFSA has been asked to provide such information as: data on number of animals killed, methods used, misses and reasons for misses, and timings from shooting to stunning to bleed out to skinning or carcase dressing.

Data on how long it takes for the animals to become irreversibly unconscious, with description of killing methods and data on bleed time have also been requested.

The panel has been asked to conclude whether seals suffer in traditional hunt.

ASSESSMENT

1. INTRODUCTION

In 1990, a detailed assessment was made of Norwegian sealing operations in the Greenland and Barents Seas in the period 1982-1988. The resulting report (Anon. 1990b) addressed general aspects of sealing as well as specific incidents that had been reported by inspectors that had accompanied sealing vessels in this period. This report has been a valuable source of information in the preparation of the present assessment. It also led to some important revisions of regulations for the Norwegian hunt of ice breeding seals which have had consequences for how the hunt is practiced today. For example, the killing of unweaned pups is now prohibited, which has led to increased use of the rifle and less use of the hakapik/slagkrok as the preferred weapon for the initial stunning, since weaned pups typically are more alert and mobile than unweaned ones and tend to escape into water when approached by man. Also, because all hunting of hooded seals was prohibited in 2007 (with reference to uncertainties concerning stock size), current regulations in effect only apply to the hunt of harp seals. The revised regulations also state that the killing of adult harp seals (of both sexes) in the breeding lairs is prohibited. In order to avoid any misunderstandings as to whether a pup is weaned or not, or whether an adult animal is breeding or not, specific dates for the opening and closing of the hunting seasons have been set. In 2007, the Greenland Sea (harp) seal hunting season opened on April 10 (at 07.00 hrs UTC) and closed on June 30 (at 24.00 hrs UTC), while the Barents Sea hunt opened on March 23 (at 07.00 hrs UTC) and closed on May 15 (at 24.00 hrs UTC).

The *ad hoc* group has largely considered the issues raised by the European Food Safety Authority (EFSA) in relation to how the Norwegian seal hunt is practiced today, as regulated by the most recent versions of the Norwegian regulations. When appropriate, however, (e.g. in assessing the efficiency of killing methods), experiences from previously employed hunting practices have been used in the assessment.

EU and most European countries have animal welfare regulations based on certain animal welfare considerations, which must be adhered to in order to ensure an ethically acceptable hunting and killing of animals. Such legislation is based on the understanding that vertebrates are sentient beings, able to experience negative emotions and suffering like pain, fear, anxiety, and frustration (EU's Directorate-General for Health and Consumer Protection, 2007). The following animal welfare principles are particularly relevant to the hunting of wild mammals, including seals:

- Avoid unnecessary pain, implying that killing should ensure that unconsciousness and death are achieved as quickly as possible,
- Avoid unnecessary fear of humans during hunting and killing, implying that physical contact or closeness between animal and hunter during killing should be restricted to animals not responding with antipredatory behaviour or fear reactions,
- Give particular consideration to breeding females with young offspring, if these females respond with antipredatory behaviour or fear reactions.

Several factors may influence the choice of method of stunning and killing. Some people, including politicians, may be concerned about the effects that these operations might have on observers, in emotional and aesthetic terms. It is natural for humans to identify with an animal that is about to be killed, as we relate to the situation on the basis of our knowledge about the inevitability of death and its consequences. The experience of seeing other animals being killed does not seem to elicit any reaction in nearby animals, unless a defensive or antipredatory reaction is provoked or the animals are frightened by circumstantial influences. Also animals do not usually react with fear if another animal collapses. Although the feelings of anyone who is emotionally attached to animals should be taken into consideration, it would be unethical to allow such considerations to "tip the balance" if this meant that the best and quickest method of killing an animal was excluded out of consideration for aesthetic perceptions or "public opinion".

2. SEALS AND SEALING IN NORWAY

Marine mammals, seals included, are regarded as renewable resources in Norwegian waters. As integral parts of the ecosystems, they are implemented in current ecosystem-based management. It is an overall goal for Norwegian seal management to secure viable stocks that can sustain a well-regulated long-term harvest (Anon. 2004). Also, consideration could be given to ecological and socio-economical issues, e.g., conflicts between seals and fisheries, when management plans are implemented. Several species are hunted today, and Anon. (2004) clearly states that no hunt should be permitted unless sufficient knowledge is available about the status and abundance of the actual stock.

HUNTING OF ICE BREEDING SEALS

The target species

Harp seals

Harp seals (*Pagophilus groenlandicus*) are medium-sized phocid seals that are widely distributed in the northern Atlantic and Arctic Oceans. Adult males average 135 kg in weight and females about 120 kg (Sivertsen 1941), with lengths of about 180 cm for both sexes

(Smirnov, 1924). As the harp seal grows, its colour changes several times in association with the annual moults. The fully mature adults are whitish grey with a horseshoe- or harp-like black band running along the flanks and across the back, a pattern which has given the species its English name. The pups are born with a soft, curly, white lanugo fur (hence their name "whitecoats"), which is shed at 2-3 weeks of age to reveal a grey short-haired coat which is marked with darker grey and black spots; these animals are referred to as "beaters". During the consecutive moults, the coat of the young animal becomes lighter grey and the spots and markings grow paler, until the adult harp pattern begins to become visible, although is not fully developed until about 4 years of age.

Figure1. Adult female harp seal with its whitecoat pup.

Three stocks of harp seals inhabit the North Atlantic Ocean (Sergeant 1991). Whelping occurs east of Newfoundland and in the Gulf of St. Lawrence (the Northwest Atlantic stock), off the east coast of Greenland (the Greenland Sea or West Ice stock), and in the White Sea (the Barents Sea / White Sea stock). Relationships between the three North Atlantic populations of harp seals have been investigated (Meisfjord and Sundt 1996; Perry et al. 2000). Significant differences were observed between the Northwest Atlantic stock and the Greenland Sea and Barents Sea harp seal stocks, whilst no evidence of differences between the two latter stocks was observed.

During spring, harp seals exhibit a set sequence of activities. Whelping (in March–April), is followed by 12 days of intensive lactation, and then mating (e.g., Sivertsen 1941). Moulting of adults and immatures takes place north of each whelping location, after a further lapse of approximately four weeks. The location of these events in the Northeast Atlantic is either the fringe of winter ice lying seawards of the heavier Arctic ice off the east Greenland pack, located between the latitudes 69°N and 75°N (the West Ice stock, Øritsland and Øien 1995; Haug *et al*. 2006), or in the White Sea and south-eastern parts of the Barents Sea (the East Ice stock, Haug *et al*. 1994a).

Harp seals typically dive to 50-400 m depth, and stay submerged for between 2 and 15 min at a time. Dives are generally deeper at day than at night, and in winter than in summer (Folkow *et al.* 2004). The bulk of the harp seal diet is comprised of relatively few species, in particular capelin, polar cod, herring, krill, and pelagic amphipods (Nilssen et al. 1995a, b; Lindstrøm *et al.* 1998).

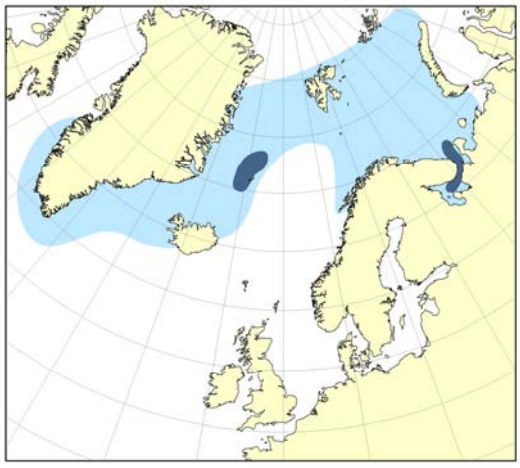

Figure 2. Harp seal distribution in the Northeast Atlantic: breeding/moulting areas (dark blue) in the Greenland Sea (left) and the White Sea/Barents Sea (right) and feeding areas (light blue).

Hooded seals

Hooded seals (*Cystophora cristata*) are fairly large, solitary ice-breeding seals that inhabit the northern Atlantic and Arctic Oceans. The males are larger than the females and on average reach lengths of 260 cm compared with 200 cm for females. Adult males weigh 200-350 kg, while females weigh 150-300 kg (Kovacs and Lavigne 1986). If provoked (particularly during the mating period) the adult male may inflate the loose skin on the top of its nose (the 'hood') for display purposes - hence the species name - and may even, when particularly excited, inflate its bright red and flexible nasal septum like a balloon through one of its nostrils. The fur of adults of both sexes is ash-grey with dark brown/black spots or patches, although it appears uniformly dark grey when wet. The pups, (called "bluebacks") are born with a slate-blue back and a creamy yellow belly, having shed their creamy grey lanugo fur *in utero*. The change in coat colouration and markings to that of the adult occurs stepwise with each annual moult, reaching the adult pattern after the third or fourth moult.

Figure 3. Adult female hooded seal with blueback.

Two (possibly three) stocks of hooded seals are assumed to inhabit the North Atlantic Ocean (Sergeant 1974; Kovacs and Lavigne 1986). Whelping occurs east of Newfoundland and in the Gulf of St. Lawrence (the Northwest Atlantic stocks), whereas a possible separate stock of

hooded seals whelps in the Davis Strait between Greenland and Arctic Canada. Furthermore, hooded seals whelp in the Greenland Sea off the east coast of Greenland (the West Ice stock).

The intensive lactation period lasts only 3–5 days, during which the pup may double its weight, from 20-25 kg at birth, to >50 kg at weaning (Bowen *et al.* 1985, Lydersen and Kovacs 1999). After weaning, the adults mate, and the females desert their pups (Bowen et al. 1985; Lydersen and Kovacs 1999). Between breeding and moulting, hooded seals may perform long feeding migrations, whereas during moult (June/July), the West Ice stock hauls out on pack ice north of the usual breeding area, i.e. northwest of the island of Jan Mayen (Folkow and Blix 1995, 1999; Folkow *et al.* 1996). Hooded seals are excellent divers that may dive to ~1000 m depth and stay submerged for >50 min at a time, and they typically seem to find their food at 100-600 m depth (Folkow and Blix 1999). In the Greenland Sea, squid appears to be the main food of the hooded seal, followed by polar cod (Haug *et al.* 2004, 2007a). In other areas they may also feed considerably on other fish species, e.g. redfish and Greenland halibut (Kapel 1995, 2000).

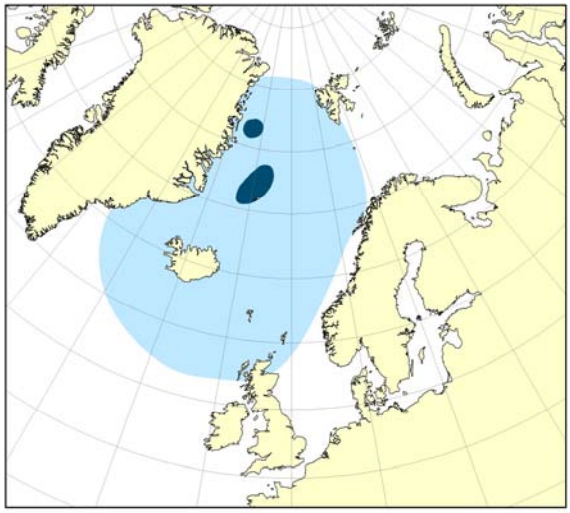

Figure 4. Hooded seal distribution in the Northeast Atlantic: Breeding area (dark blue, large), moulting area (dark blue, small) and feeding area (light blue).

Management and status of the stocks

Current management of harp and hooded seals is based on assessments performed by the Joint ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP, see ICES 2006a, b). The major functions of WGHARP include assessing the status of the populations, providing advice on sustainable harvest levels, and assessing interactions with prey (i.e. ecological role of seals). Terms of references (TORs) given to WGHARP are based on requests for information and advice related to management of the seal stocks, as provided to ICES or NAFO by commissions (e.g., NAMMCO) or member governments. Formulation of the TORs is the responsibility of the ICES Advisory Committee on Fisheries Management (ACFM) and the NAFO Scientific Council (NAFO SC). After meetings, WGHARP reports the results of its deliberations to ACFM and NAFO SC. Subsequently, ACFM and NAFO SC provide the advice requested for the north-western and north-eastern stocks, respectively. At present, WGHARP includes appointed members from Canada, Denmark (Faroe Islands and Greenland), Germany, Iceland, Norway, Russia, UK and USA.

Harp seals – Barents Sea / White Sea

ICES (2006a) concluded that recent removals have been below the recommended sustainable yields, and that continuation at current catch levels will probably result in an increase in population size. There is some evidence that densities may already be so high that some biological processes, like rate of maturation, may be showing density-dependent effects. Based on available data on pup production estimates (from Russian aerial surveys 1998-2003, see Potelov *et al.* 2003; ICES 2006a) and population productivity, ICES estimated the following 2005 abundance of harp seals in the White Sea: 2065000 (95 % C.I. 1497000-2633 000) 1+ animals (i.e., seals that are one year old or older) with a pup production of 361000 (95 % C.I. 299000-423000). A continuation of current catch levels will probably result in an increase in population size, and ICES emphasised that an annual catch of 78198 1+ animals, or an equivalent number of pups, in 2006 and the following years would sustain the population at the present level over a 10-year period. Therefore the total allowable catch (TAC) for harp seals in the White Sea / Barents Sea in 2007 was set at this level. Catches twice sustainable levels will result in the population declining by approximately 53-67 % over the next 10 years.

Harp seals – Greenland Sea

Available knowledge on both previous and present abundance of Greenland Sea harp seals is limited. As judged both from catch-per-unit-effort analyses and mark-recapture pup production estimates, it has been assumed that the stock has increased ever since the early 1960s, but data on the level of increase have been rather imprecise (Ulltang and Øien 1988; Øien and Øritsland 1995). Updates of the mark-recapture-based pup production estimates indicated a pup production in 1991 of 67300 (s.e. = 5400, cv = 8.0 %) (ICES 2001). Aerial surveys performed in 1991 suggested a minimum pup production in that year in excess of 55000 (Øritsland and Øien 1995). New aerial surveys conducted 11 years later (in 2002, see Haug et al. 2006) yielded an estimate of 98500 (s.e. = 16800, cv = 17.0 %).

Incorporating available pup production estimates into a population model suggested population growth after 1970, and a current (2005) population size of 620000 seals (95 % CI 418000 – 823000) (ICES 2006a). ICES has concluded that recent removals have been below the recommended sustainable yields, and that prolongation of current catch levels will probably result in an increase in population size. An annual catch of 31200 1+ animals, or an equivalent number of pups, in 2006 and the following years would sustain the population at the present level over a 10-year period. Therefore TAC for harp seals in the Greenland Sea in 2007 was set at this level. Catches twice sustainable levels will result in the population declining by approximately 45-55 % over the next 10 years.

Hooded seals – Greenland Sea

Knowledge of possible variations in the abundance of Greenland Sea hooded seals is limited. As judged both from catch-per-unit-effort analyses and mark-recapture pup production estimates, it has been assumed that the stock has increased ever since the early 1960s, but data on the level of increase have been rather imprecise (Ulltang and Øien 1988; Øritsland and Øien 1995). Aerial surveys to estimate the hooded seal pup production were attempted, although with little success, in the Greenland Sea both in 1959 (Øritsland 1959; Rasmussen 1960) and in 1994 (Øritsland and Øien 1995). More successful aerial surveys suggested a minimum pup production of approximately 24 000 (s.e. = 4600, cv = 19.0 %) in 1997 (ICES

1998, 1999). New aerial surveys to assess the Greenland Sea hooded seal pup production were conducted in 2005. Using the same methodology as in the 1997 survey, the results from the 2005 survey suggested a current hooded seal pup production in the Greenland Sea of 15200 (s.e. = 3790, cv = 24.9 %) (Salberg *et al.* 2007). The results indicate that the 2005 pup production of hooded seals in the Greenland Sea is considerably lower than in 1997. New surveys were conducted in 2007 (Haug *et al.* 2007b) – the data are currently being analysed.

Incorporating available pup production estimates into a population model indicates that the population of Greenland Sea hooded seals substantially decreased from the late 1940s and up to the early 1980s (ICES 2006b). In the most recent two decades, the stock appears to have stabilized at a low level, with approximately 71400 (95 % C.I. 38400-104400) 1+ animals in 2006, which may be only 10-15 % of the level observed 60 years ago. ICES therefore conclude that harvesting should not be permitted, with the exception of catches for scientific purposes from 2007 onwards. This has been implemented by Norwegian management authorities.

The catches

Harp seals - Barents Sea / White Sea

Prior to 1875, catch information is sparse, but Iversen (1927) assumed that the catches were probably quite small, amounting to some hundreds annually. After 1875, the total annual catches increased, with between 15000 and 60000 up to around 1900, more than 100000 after 1900, and with the largest catches taken in the 1920s and 1930s (annual average of between 200000 and 300000 animals, peaking in 1925 when nearly 470000 seals were taken) (Iversen 1927; Sivertsen 1941; Nakken 1988; Skaug *et al.* 2007).

While exploitation was low during World War II, the total hunting pressure increased from 1946 onwards, with average annual catches of between 150000 and 200000 up to 1955 (ICES 2006a). Quotas for the Soviet catches were introduced unilaterally in 1955 (100000 seals, Yakovenko 1963) and were gradually reduced until 1965 when a quota of 34000 seals was implemented for the total catch (Norway and Soviet catches considered together). Adult females were protected in the whelping patches from 1963, and Soviet catches of 1+ seals were stopped in 1965 (Kjellqwist *et al.* 1995). Catches increased in the late 1970s and in the 1980s (annual quotas increased to 50000 in 1977, 60000 in 1981, 75000 in 1982, a maximum of 82000 in 1983, then decreased to 80000 in 1984-1987, see ICES 2006a). The total quota was reduced to 70000 in 1988 and yet further to 40000 in 1989-1998. An increase in numbers should be expected due to the implementation of several catch regulations such as full protection of whelping females from 1963, a halt in Soviet catches of 1+ animals and a general decrease in catches due to a new quota system from 1965, and the general lack of capacity to take recommended TACs in the most recent (15) years. In 2004 there was no harvest at all from this population, and the majority of the low catches taken between 1965 and 2006 were pups. Recent catches have been well below assumed sustainable levels (ICES 2006a).

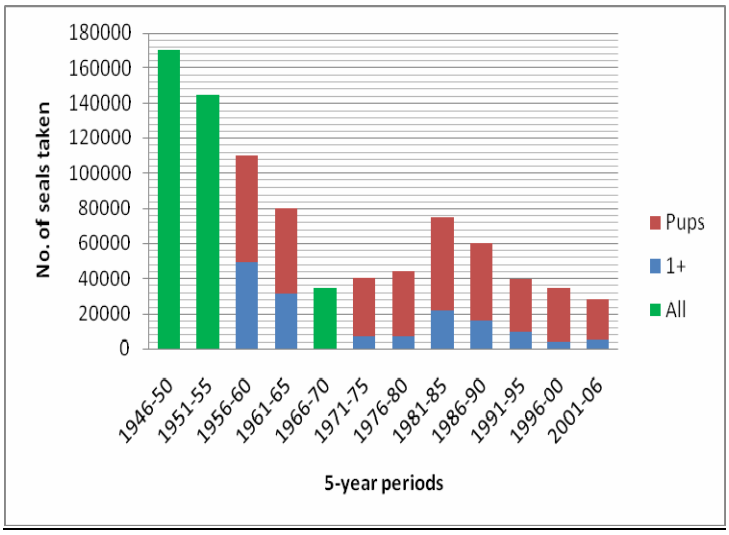

Figure 5. Total catches of harp seals (pups and one year old and older animals – 1+, in some periods only the total number taken is available) in the Barents Sea / White Sea after World War II. Total catches are given as means for 5-year periods; note that the last period is a 6-year period.

Harp seals – Greenland Sea

The Greenland Sea (West Ice) stock of harp seals has been subject to commercial exploitation for centuries (Iversen 1927; Nakken 1988; Sergeant 1991). Exploitation levels reached a historical maximum in the 1870s and 1880s when annual catches of harp seals (pups and adults) varied between 50000 and 120000 (Iversen 1927). It was evident that the catch levels in the 1870s were higher than the stock could sustain, and some regulatory measures (mainly designed to protect adult females) were introduced in 1876 (Iversen 1927). In the first decades of the 20th century the annual harp seal catches varied between 10000 and 20000 animals, increasing to around 40000 seals per year occurred in the 1930s (Iversen 1927; Sergeant 1991).

The pre World War II catch statistics are even more uncertain for this population than for the White Sea population. Analyses should therefore only include data from 1946 onwards. After a 5-year pause in the sealing operations during World War II, total annual catches quickly rose to a post-war maximum of about 70000 in 1948, but then followed a decreasing trend until quotas were imposed in 1971 (Sergeant 1991; ICES 2001). From 1955 to 1994, a minor part of the catches were taken by the Soviet Union / Russia, and the total annual catches from 1971 to the present have varied between a few hundred to about 17000 (ICES 2001).

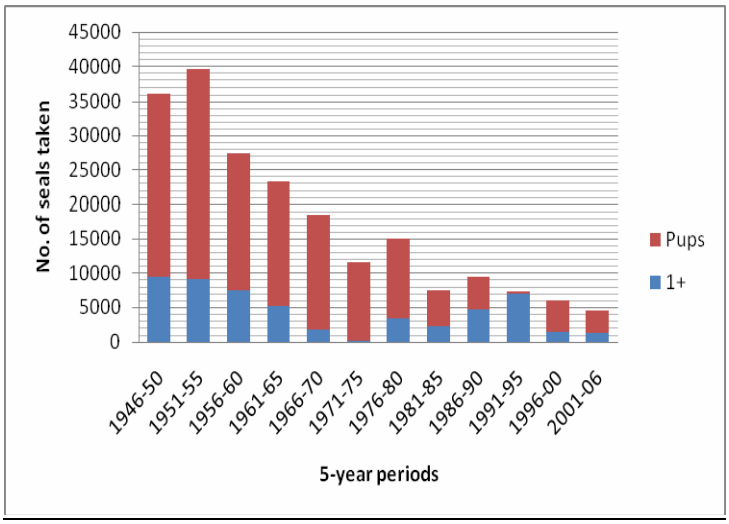

Figure 6. Total catches of harp seals (pups and one year old and older animals – 1+) taken in the Greenland Sea after World War II. Total catches are given as means for 5-year periods; note that the last period is a 6-year period.

Hooded seals – Greenland Sea

Harp seals are assumed to have been the most important catch object in the Greenland Sea in the early years, whereas hooded seals occurred more frequently in the catches from the 1890s onwards (Iversen 1927). After 1920, however, a substantial increase occurred in the hooded seal hunt with average annual catches ranging from between 40000 to 50000 individuals (Øritsland 1959). After a 5-year pause in the sealing operations during World War II, total annual catches quickly rose to a post-war average annual level of 50000 to 60000 in the early 1950s. It was evident that these catch levels were higher than the stock could sustain, and some regulatory measures (mainly to reduce effort) were introduced in 1958 (Øritsland 1959; Rasmussen 1960). The total annual catches have subsequently followed a decreasing trend, primarily due to reduction in catch effort. Quotas were imposed in 1971 (Kovacs and Lavigne 1986). Average annual catches in the early 1960s were approximately 47000 individuals, whereas in the early 1980s the level had sunk to approximately.8000 seals. In the past 25 years, the average annual catch level has remained less than 5000 animals (almost exclusively pups), which is considerably lower than the TACs given for the period (ICES 2006b).

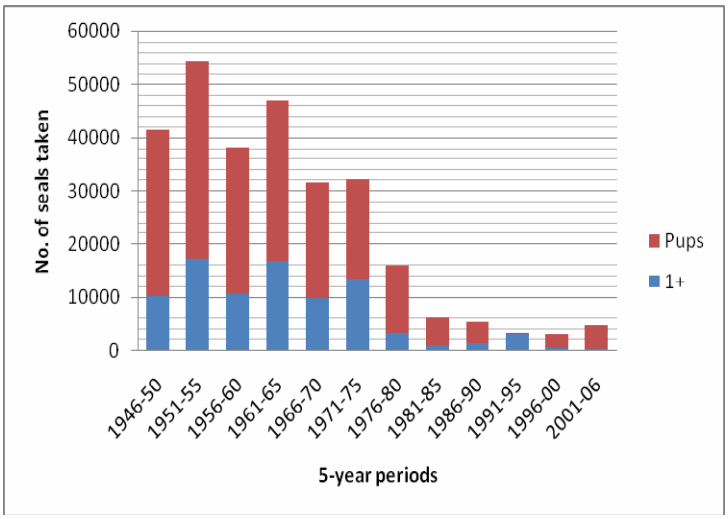

Figure 7. Total catches of hooded seals (pups and one year old and older animals – 1+) taken in the Greenland Sea after World War II. Total catches are given as means for 5-year periods; note that the last period is a 6-year period.

HUNTING OF COASTAL SEALS

The target species

Harbour seals

Harbour seals, *Phoca vitulina,* are distributed in coastal areas of the Northeast Atlantic from northern Portugal to the Barents Sea (including also the British Isles, Iceland, and western Spitsbergen) and in the Baltic Sea (Bigg 1981; Wiig 1989; Henriksen *et al.* 1997). In Norway, the species is resident along the entire coast where they occur in three distinct types of habitats: open rocky coasts, deep fjords and estuarine sandbanks (Bjørge 1991). Harbour seals may travel several tens of kilometres to forage, but they show site fidelity and return regularly to haul out in what appears to be their home range (Bjørge *et al.* 2002a).

The resident nature of the harbour seal makes them likely to interact with local fisheries and fish farms (e.g., Henriksen and Moen 1997; Bjørge *et al.* 2002b). Harbour seals are fish feeders, foraging primarily in coastal waters. In Norway they are known to feed particularly on species such as herring, saithe and cod (Olsen and Bjørge 1995; Berg et al. 2002). Harbour seals are also final hosts for the sealworm, *Pseudoterranova decipiens,* which may severely affect commercial fishes such as the cod (Andersen *et al.* 1995).

Grey seals

There are three main groups of grey seals, *Halichoerus grypus,* in the North Atlantic. One of these is distributed from the British Isles northwards, along the entire coast of Norway and the Murman Coast of Russia (Bonner 1981, Wiig 1986, Haug *et al*. 1994b). The species is resident in Norwegian coastal waters where Wiig (1986) suggested a discontinuous distribution from Rogaland to Finnmark, with the largest abundance in mid Norway (between 63°N and 68°N). These patterns of distribution were supported by data from Nilssen and Haug (2007).

In Norway, grey seals show wide dispersal along the entire western and northern coast on the outlying small rocky islands and exposed islets, yet there are no clear migration patterns (Bjørge *et al.* 2002a). Grey seals in Norwegian waters appear to be very piscivorous in their

feeding habits, with particular preference for gadoids (cod, saithe and haddock) and wolffish (Tuominen *et al.* 2006).

Management and status of the stocks

Coastal seal management

Prior to 1973, the hunt of coastal seals in Norway was virtually unregulated (Anon. 1990a). For harbour seals only some local protection initiatives had been taken during the 1960s in some areas in Nordland and Møre and Romsdal counties (Anon. 1990a, Bjørge 1991). In 1973, however, regulatory measures were introduced, with a general protection of harbour seals in southern Norway from Østfold to the Sogn and Fjordane counties.

A new management regime was implemented for the coastal seals in Norway in 1997. The major management objective was to secure viable stocks within their natural distributional areas. However, there was also a requirement that consideration should be given to conflicts between seals and fisheries. In areas where seal numbers were supposed to sustain a harvest, hunting could be used to control population sizes. This objective was defined in a consensus report from a group of experts, including scientists and managers from the Ministry of Fisheries and the Ministry of Environment (Anon. 1990a). One implication of the new management regime was that the hunt should be restricted by quotas, and new hunting periods were implemented.

Coastal seal quotas are set annually by the Norwegian Ministry of Fisheries, based on advice received from the national Marine Mammal Advisory Board. This council's main objective is to provide management advice to Norwegian authorities in all questions regarding marine mammals. Coastal seal management is intended to be scientifically-based, and the quotas are based upon recommendations provided by the Institute of Marine Research (IMR) which is responsible for the collection and analyses of all relevant data. Initially, recommended quotas were generally set at 5 % of current abundance estimates. In areas with particular conflicts between coastal seals and fisheries, Norwegian management authorities have occasionally attempted to use hunting to control population size by increasing the recommended quotas by 20-30 %. For grey seals, quotas were increased in some areas due to assumed immigration of grey seals from large neighbouring colonies, e.g., from UK in the south (Bjørge and McConnell 1986, Wiig 1986, 1987), and from the Murman coast in Russia in the north (Haug *et al*. 1994b, Henriksen *et al*. 2007).

The hunt along the Norwegian coast is carried out using rifles. The requirement for the ammunition is the same as the requirements for ice-breeding seals (see Chapter 3).

Harbour seal status

Øynes (1964, 1966) suggested that the total harbour seal population in Norway may have been about 4000 animals in the early 1960s. He also suggested that the species had suffered a severe decline prior to the 1960s and that it was threatened in some areas. To obtain data to be used as a basis for management, more extensive studies of harbour seals were carried out along the Norwegian coast (Fig.1) during the period 1977-1989 (Bjørge 1991; Bjørge and Øien 1999). These studies indicated that the number of harbour seals inhabiting Norwegian coastal waters was probably around 3600 animals.

The introduction of quotas required updated information on seal abundance along the Norwegian coast, and it was recommended that a monitoring programme should be

established with harbour seal populations surveyed approximately every five years (Anon. 1990a). A first survey, primarily based on aerial photographic surveys, but supplemented with boat-based visual countings in a few areas, was conducted during moult (August) in 1996-1999 and resulted in a point estimate of 7465 harbour seals for the entire Norwegian coast (Bjørge *et al.*, 2007). Even though the methodology applied in 1996-1999 (total counts of animals in the moulting lairs) differed from previous studies, the new point estimate was taken as an indication of recent growth in the harbour seal population.

A new survey was conducted in 2003-2006, in which harbour seals were counted along the entire Norwegian coast at known moulting haul-out sites in the period mid-August to early September (Nilssen *et al.* 2006). The 2003-2006 surveys revealed a total minimum population of 6668 harbour seals, approximately 700 seals lower than the estimate obtained in 1996-1999.

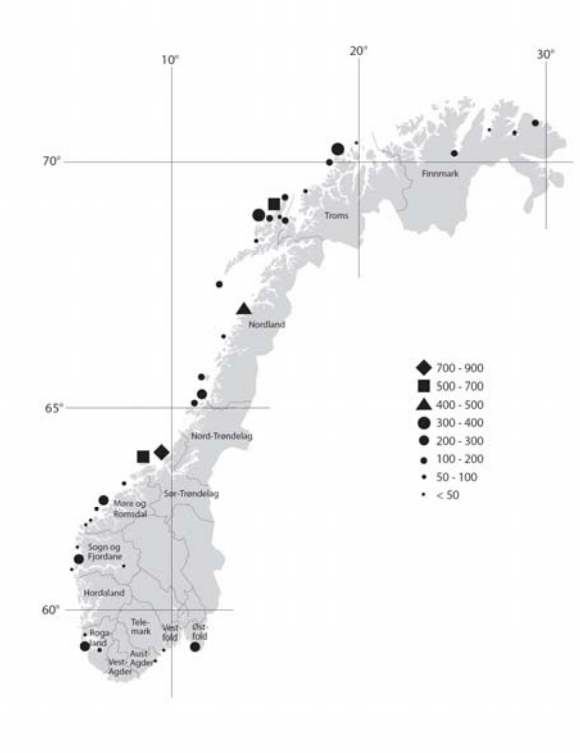

Figure 8. Harbour seal colonies along the Norwegian coast. Numbers of seals are results from recent abundance estimate surveys (2003-2006). From Nilssen et al. (2006).

Grey seal status

Øynes (1964, 1966) concluded that no grey seal pup production occurred in the southern parts of Norway (south of Stad) in the early 1960s. Only a low and scanty abundance of the species was recorded in the northernmost parts of the country (north of Vesterålen). However approximately 660 pups were born annually in the coastal areas between Stad and Finnmark.

The introduction of quotas required updated seal abundance information, and it was recommended that a monitoring programme be established in which the grey seal populations would be surveyed every five years (Anon. 1990a). A first survey, covering the areas from Sør-Trøndelag and northwards to the Russian border, was conducted in 1996-1998 and resulted in a point estimate of approximately 4400 grey seals (Bjørge and Øien 1999).

A second survey (2001-2003, see Nilssen and Haug 2007), resulted in a minimum estimate of 1159 pups, which indicated a total minimum estimate of about 5800-6600 grey seals (including pups), which is higher than the estimate from 1996-1998. However, it is not clear if this represent an actual change in population, or reflects changes in methodology, including an increase in area covered by the more recent survey efforts.

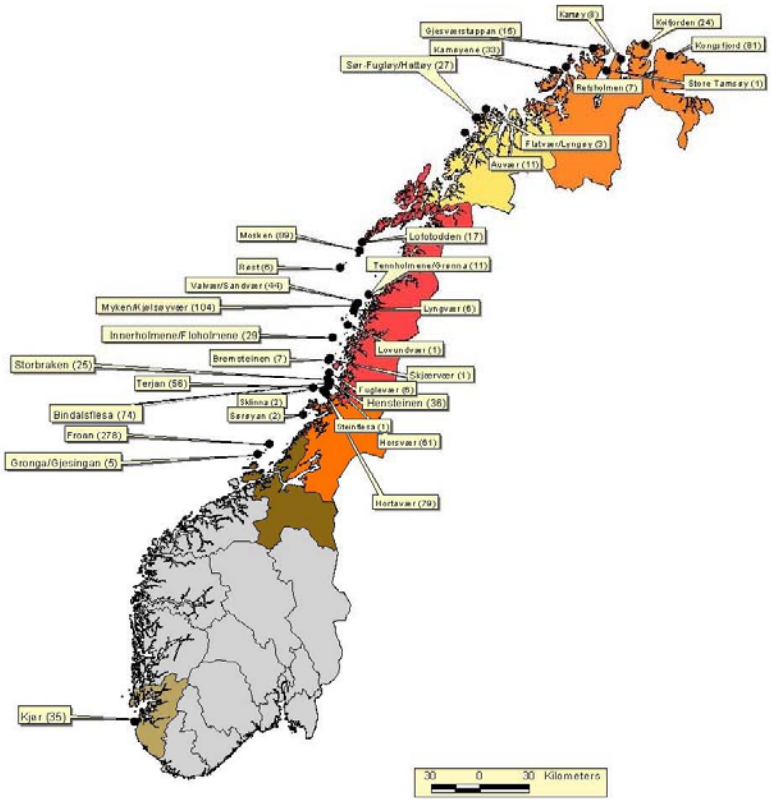

Figure 9. Grey seal colonies along the Norwegian coast. Numbers of seal pups observed during the 2001-2003 surveys are given in parentheses. From Nilssen et al. (2004).

The catches

Harbour seals

Harbour seal hunting is long-standing tradition in Norway, providing an important food and fur resource for the coastal communities. In the first part of the 20th century, harbour seals were regarded more as vermin, with a bounty paid in some areas, resulting in local depletion of stocks. During the 1960s, however, interest in harbour seal hunting decreased in Norway (Bjørge 1991).

Only limited quantitative historical data on harbour seal hunting activities in Norway are available prior to 1997. However, in a culling programme during the period 1980-1987, 1236 harbour seals were shot in the areas from Møre and Romsdal to Nordland (Bjørge and Øien 1999). However, as all licensed coastal seal hunters in the latest decade have been obliged to report their hunting results to the authorities, catch statistics are available from 1997.

Harbour seals along the Norwegian coast are also subjected to by-catch mortality. In a mark-recapture experiment between 1978 and 1998, in which 630 harbour seal pups were tagged, 13 % of the tags were returned (Bjørge *et al.* 2002a). Interactions with fish farms by harbour seals are known to occur (Bjørge *et al.* 2002b) and interactions may also occur between harbour seals and salmon river fisheries (Henriksen and Moen 1997). According to current regulations, it is permitted to shoot seals that interact with fish farms and salmon fisheries, and these removals are supposed to be reported to the authorities.

Grey seals

Currently, all hunters must obtain permission to hunt Norwegian grey seals from Norwegian management authorities, and they must also report the results from their hunt. Grey seal catch statistics are available since 1997. Only 13-49 % of the quotas recommended by the IMR, and 11-35 % of the quotas issued, were taken annually in the period 1997-2002 (total annual removals varying between 34 and 176). The increased quotas and bounty paid from 2003 onwards resulted in increased catches (302-379 per year in the entire period).

Grey seals along the Norwegian coast are also subject to some bycatch mortality. In a mark-recapture experiment, in which 3571 grey seal pups were tagged, 7 % of the tags were returned (Bjørge *et al.* 2002a). Interactions with fish farms by grey seals are known to occur. Fish farmers are allowed to kill seals when they interact with farm operations and they are supposed to report on the takes.

Table 1. *Quotas and catches of coastal seals in Norway in 1997-2006.*

	Harbour seals			Grey seals		
	Recommended quota	Issued quota	No. of seals taken	Recommended quota	Issued quota	No. of seals taken
1997	230	230	60	260	260	36
1998	242	242	83	267	319	34
1999	288	370	308	268	373	130
2000	380	438	359	625	625	176
2001	473	508	466	285	625	105
2002	504	508	412	285	355	110
2003	511	949	457	355	1186	353
2004	511	949	549	368	1186	302
2005	550	989	614	400	1216	379
2006	305	750	660	400	1536	329

CATCHES AT SVALBARD

Four seal species are year-round residents at the Svalbard archipelago (Kovacs *et al.* 2004): walrus (*Odobenus rosmarus)*, harbour seals, ringed seals (*Phoca hispida),* and bearded seals (*Erignathus barbatus)*.

The ringed seal is the most abundant mammal in the Svalbard area with an estimated annual pup production of approximately 20000 (Lydersen 1998). Ringed seals are protected in the breeding season (March – April), but can be hunted by licensed hunters outside this period (Kovacs *et al.* 2004). No systematic harvest records exist, but presumably some few hundred seals are taken annually, mainly for dog food (Lydersen 1998).

Currently, bearded seals are protected from hunting during the breeding season in spring, but licensed hunters can shoot bearded seals at Svalbard at other times of the year (Kovacs *et al.* 2004). Hunting statistics are not maintained, but the numbers taken annually are quite low.

The hunt is carried out using rifles and the ammunition requirements are the same as for ice-breeding seals (see Chapter 3).

3. ANATOMICAL AND PHYSIOLOGICAL CHARACTERISTICS

RELEVANT ANATOMICAL CHARACTERISTICS

Anatomically, seals conform to the general mammalian pattern: their skeleton is comprised of the same bone parts and the internal organs are the same and have the same relative position in the body as in any other mammal. However, compared to terrestrial animals of the same size the seal's body is characteristically torpedo-shaped, the limbs are short and there is a lack of external landmarks on its torso. Therefore, unlike most other forms of wildlife hunts, the head (and brain) is the preferred target rather than the thorax as in terrestrial large game.

Skeletal and skull (cranium)

The skeleton of seals, like its terrestrial relatives, consists of the skull, the spinal vertebra, four limbs and the ribs. The skull of pinnipeds is characterized by a short snout and large orbits. The cranium is thickest in the basal and caudal parts (*pars basilaris, os temporale, os basisphenoidale*) and thinner in the frontal and lateral parts (*os frontale, os parietale*). The thickness varies to some extent among different species, but most importantly it varies between animals of different size (age). Generally large adults, especially males, have the thickest skull, and deep-diving seals tend to have somewhat thicker skull bones than shallow-diving ones. The outer surface of a seal skull (*Ossa frontale*) is smooth while the inner surface has several ridges (*cristae*) and larger grooves forming a negative impression of the brain. The thickness of the scull bones will therefore vary considerably. In newborn harp seal pups the skull thickness varies from about 0.5 mm in the grooves to 2 mm on the ridges. In a one year old harp seal the ridges are slightly higher and the thickness varies from about 0.8 mm to 3.6 mm.

The circulatory system

The anatomy of the heart of pinnipeds is of normal mammalian construction, though it tends to be broader and flatter than the hearts of terrestrial mammals. Like in other four-legged animals the heart is placed behind and below the shoulder blade, and takes up much of the space in the lower part of the thoracic cavity, from about the 3rd to the 5-6th rib. The anatomy of the arterial system of pinnipeds is much similar to that in dogs (*Canis canis*). However, most seals have a distinct dilatation or enlargement of the aortic arch compared to terrestrial animals. In the aortic arch, dorsally to the brachiocephalic trunk, the arteries arise that are branching into the *a. axillaris et brachialis* (the arteries to the forelimbs that are cut when

seals are bled) and several arterial branches supporting the spinal cord and brain with blood (*truncus costocervicalis*).

THE PHYSIOLOGY OF SEALS AS DIVING MAMMALS

Seals are aquatic mammals that search for and catch their prey under water. Many seal species usually only dive for a few minutes at a time, but the dives are repeated with only brief interruptions at the surface for breathing, for most of the day as well as the night, often for several weeks. On occasion, however, seals may perform prolonged dives (> 20 min for the harp seal (e.g., Folkow et al. 2004) and > 50 min for the hooded seal (Folkow and Blix 1999). Such remarkable performances are possible due to a range of morphological and physiological adaptations that are characteristic of seals as diving mammals.

Oxygen stores

Earless (phocid) seals are able to store fairly large amounts of oxygen in their tissues that may be used during diving when lung gas exchange with the atmosphere is no longer possible. Most of the oxygen is stored in the blood, reversibly bound to the respiratory protein haemoglobin in the red blood cells. By having a blood volume that is more than twice that of a human of similar size, and a haemoglobin concentration that may be more than 50 % higher than in man, some seal species are able to store 3-4 times as much oxygen in the blood per unit weight, as a human (Lenfant *et al.* 1970, Snyder 1983). Moreover, the skeletal muscles of seals contain another reversible oxygen-binding protein, myoglobin, in concentrations that may be 8-10 times higher than those in a typically non-diving species such as man (Lenfant *et al.* 1970, Burns *et al.* 2007). The lungs of seals are less important as oxygen stores; in fact seals generally exhale prior to, or during, diving, presumably in order to avoid buoyancy problems and the 'bends' (Kooyman and Ponganis 1998).

Strict economy with oxygen stores

Given the size of their oxygen stores, seals would be expected to be able to perform dives lasting about 5 times longer than the typical capacity of a breath-hold-diving human; i.e. for 10-15 minutes. But most species of seals can do much better than this; the hooded seal may dive for almost one hour at a time (Folkow and Blix 1999), while the much larger southern elephant seal (*Mirounga leonina*) may stay submerged for a remarkable 2 hours (Hindell *et al.* 1991). Such accomplishments are possible only because these seals conserve their oxygen stores by applying a strict economy to their use, through both behavioural (i.e. reduced physical activity) and physiological means. In particular, a selective redistribution of blood flow occurs during diving, directing the main blood supply to those tissues that are particularly vulnerable to lack of oxygen (e.g., the brain, to some extent the heart, and the uterus and foetus of pregnant females), while other tissues, with less critical oxygen requirements, may receive a blood supply that is only a small proportion of 'normal', at-surface levels (e.g., Scholander 1940, Zapol *et al.* 1979).

This blood redistribution is achieved through a massive peripheral constriction (closing) of those blood vessels that supply the less vulnerable tissues (which, in fact, includes the majority of tissues/organs). The resulting huge increase in blood flow resistance is compensated by a large drop in cardiac output, as effected through a dramatic slowing of the heart rate, from 60-100 beats per minute (bpm) to less than 10 bpm in some cases (e.g., Blix and Folkow 1983, Thompson and Fedak 1993). This reduction in the heart rate also

significantly reduces its work load, to the extent that blood supply to the heart may be reduced to only 10 % of the at-surface levels (Zapol *et al.* 1979). The redistribution of blood, often referred to as the 'diving response' (Scholander 1940), is linked to a reduced metabolism (hypometabolism) and an increased reliance on anaerobic (non-oxygen dependent) metabolism in many tissues (Scholander 1940, Hochachka and Murphy 1979). One important factor contributing to the reduced metabolism is a relatively rapid body cooling, causing the body core (including brain) temperature of the seal to drop by several degrees celsius during diving (Hill *et al.* 1987, Odden *et al.* 1999). This cooling decreases tissue metabolic rate, and thereby contributes to the reduced rate at which the oxygen stores are depleted.

In addition, seals are endowed with an enhanced tolerance to lack of oxygen (hypoxia) (e.g., Kerem *et al.* 1973, Henden *et al.* 2004). This feature is displayed by several tissues and allows the maintenance of cellular integrity, even if the oxygen content of arterial blood drops to very low levels. The mechanisms behind this hypoxia tolerance are only partially understood, but involve a high glycolytic (anaerobic) metabolic capacity (e.g., Hochachka and Murphy 1979), mechanisms that stabilise the electrolyte balance across cell membranes (Ramirez *et al.* 2007), and an enhanced tolerance towards the oxidative stresses that follow in the aftermath of a hypoxia exposure (Zenteno-Savín *et al.* 2002).

Choice of diving strategy

It is important to emphasise that the mechanisms that effect a reduced tissue metabolism, thereby conserving oxygen stores, although abrupt when activated, are not 'on-off' mechanisms that are automatically activated whenever a seal dives. For example, a harp seal that makes a short dive underneath an ice floe does not display the full diving response, since this would be unnecessary in order to spend 10-20 seconds under water. Thus, the extent to which the oxygen conservation mechanisms are activated depends on the expected duration of each underwater excursion (Blix and Folkow 1983, Ramirez *et al.* 2007). During routine foraging diving, only a small percentage of dives typically approach the maximum diving capacity of the animal, the large majority of dives being short enough to allow the animal to operate fully aerobically (Butler and Jones 1997, Kooyman and Ponganis 1998).

Implications for death criteria

Seals in general have a large and impressive capacity to stay submerged for extended periods of time, if necessary, due to the mechanisms described briefly above, and which can be summarised as follows: a) adaptations allowing large amounts of oxygen to be stored in their tissues prior to diving, b) an ability to reduce the rate at which these oxygen stores are depleted during the dive, by a slowing of the metabolic rate through different means, and c) an enhanced capacity for anaerobic metabolism. Additionally, since seals are adapted to life in ice-cold water, their (peripheral) tissues are very tolerant to cold and may therefore remain functional even after exposure to low air temperatures in connection with skinning.

These features may enable the skeletal muscles and the heart of seals to continue to contract long after the animal has been killed. This phenomenon probably explains some reports of seals being skinned 'alive' during the hunt. A continued contraction of the heart, combined with the low susceptibility of seal blood to clot, at least while it remains contained in the blood vessels, might also cause other tissues to maintain a certain level of function for several minutes after killing, unless the animal is properly bled. This could cause particularly dramatic effects if the lower part of the brain, the brainstem, remains intact, since this part of

the brain is responsible for regulation of breathing. Thus an irrevocably unconscious, and therefore painfree, animal might continue to display breathing activity for several minutes.

4. THE NORWEGIAN PACK ICE HUNT

HUNTING PRACTICES

The Norwegian pack ice hunt for harp and hooded seals, as performed in recent years according to regulations dated 11 February 2003 (Anon. 2003), is described below. The hunt is surveyed by authorized governmental inspectors who accompany each sealing vessel to ensure that the sealers adhere to the regulations.

In the Norwegian pack-ice hunt, ocean-going vessels registered in the register of fishing vessels and considered to be suitable for and equipped for seal hunting, are permitted to be used. The crew is usually of 13-15 persons. According to the regulations relating to the hunt, vessels participating in the seal hunt must keep a catch logbook and carry an inspector (usually a veterinarian) on board during the hunt. Vessels may also be required to carry international observers on board. It is prohibited to catch un-weaned seal pups and to hunt adult female seals in whelping areas.

In addition the following hunting methods are prohibited:

- Use of lines, nets or any form of trap
- Use of shotguns
- Use of hakapik as first weapon on seals over 1 year
- Use of slagkrok on seals over 1 year
- To strike with a hakapik/slagkrok anywhere but on the skull
- To hunt adult seals in whelping areas
- To hunt seals in the water
- To kill seals in artificial light

Only marksmen who have passed a separate shooting proficiency test (usually 2-3 persons/boat) may shoot seals during the hunt. A new test must be taken prior to every season. The test must be taken with the same weapon, and the same type of ammunition, as used during the hunt. The master of the vessel must have attended an annual one-day training and information course held by the Directorate of Fisheries for seal hunters and this also applies to the other members of the crew every second year.

Harp seals appear to be less selective than hooded seals with regard to the quality of the whelping ice, and sometimes whelp on thin annual ice, or even on newly frozen continuous parts of ice, which may break up into much smaller ice floes under windy conditions. Harp seal aggregations may, however, be encountered on continuous ice or in dense drift ice, and the sealers then sometimes chose to operate on the ice during hunting. This type of operation may be very efficient since harp seals may aggregate in quite large and dense concentrations, allowing the harvest of large numbers of animals within a limited area and period of time

During ice-based hunting, the sealers are landed on the ice, bringing rifles, the mandatory hakapik and knives. All animals over one year (1+) must be shot through the head, using

approved rifles and expanding bullets. Pups may be shot with a rifle, or the hakapik or slagkrok may be used as first weapon. In the initial period after the harp seal pup is weaned, it generally demonstrates a minimal, or absence of, response when a person approaches, and the sealers might be able to walk right up to it and stun/kill it with hakapik or slagkrok. When the pups become old enough to be able to enter the water (at approximately 2 weeks old) they will usually try to escape, and will usually be stunned/killed by a rifle shot from the main boat. In slack ice conditions, the shooting might also be conducted from smaller boats (dinghies) or from the ice. Today, almost all seals hunted are shot since the hunt starts after pups are weaned. The estimated shooting range will usually vary between 10 to 70 m with an average of about 30 m.

1+ animals may only be shot under those conditions that allow the subsequent immediate and mandatory use of the hakapik and bleeding on the ice. All seals are routinely required to be struck in the brain with the spike of a hakapik before they are bled. This requirement is independent of the method used for stunning, and ensures that the seal is dead, or remains in a state of unconsciousness, until it has been bled out. Thus, the shot animal is forcefully hit on top of its head with the spike of the tool, which is then driven into the brain of the animal and twisted to cause instant and irrevocable death. Finally, the dead animal is turned on its back and a ventral (longitudinal) cut is made from the lower jaw to the sternum, and down on both sides of the thorax, to expose the brachial arteries and associated arteries/veins supplying the front flippers, which are then cut to bleed the animal. After bleeding, the seal carcass is winched on board the sealing vessel for processing, by means of a loop at the end of a long steel wire threaded over one of the hind flippers. It is prohibited to fasten lines to the animals on the ice or hook them before they have been struck with the hakapik and bled.

During hunting from the main boat, the current regulations permit individual seals to be bled on board in exceptional cases provided that they are taken on board immediately and "conditions otherwise so indicate". This means that if a seal has been shot, and it would be too dangerous for people to step down on the ice floe to finish the prescribed procedure with hakapik and bleeding out on the ice and it is obvious that the shot has hit in the brain, and the seal is judged to be dead (brain dead), it might be hooked (pups) or hauled (1+) onto the boat before it is struck with the hakapik and bled out.

Russian authorities do not permit Norwegian sealing vessels to operate in harp seal rookeries at the mouth of the White Sea. Instead, the vessels must wait for this ice to drift into the Barents Sea. The hunt then typically operates from smaller hunting boats that are launched from the mother vessel, and which manoeuvre in ice, which is frequently very open, to come within shooting range of hauled-out animals. This type of boat-based seal hunt may also be practiced in the Greenland Sea under those conditions when currents and/or winds cause the drift ice to open up. During this type of boat-based hunt, shot animals should be struck with the hakapik spike and bled as soon as possible. According to regulations, each rifleman must be accompanied by at least one person who is responsible for striking and bleeding the shot animals.

Hooded seals prefer multi-year solid ice floes, and in a breeding lair each floe usually holds only one "family" (male, female and pup). The typically large size of the floes means that the hunting operations on the ice are easier for hooded seals than for harp seals. However, since breeding hooded seals are usually dispersed over a large area, the sealing vessel must manoeuvre from ice floe to ice floe, often in dense ice, which may make progress slow. According to present regulations, the hunting of hooded seals is not permitted (Anon. 2007), but the general hunting procedures for hooded seals in previous years were similar to those described above for harp seals: that is, the seals are shot through their heads, then struck with the hakapik in the skull and bled.

The flensing (skinning) of the seal, usually starting from 5 minutes and up to 4-5 hours after the animal was bled, is completed by extending the ventral thoracic cut from the tip of the lower jaw to the anus of the animal. The sculp, that is the skin and subcutaneous blubber layer that envelopes the body core and that may represent more than 40 % of body mass, is then stripped from the body core in one piece by the use of a sharp knife. In this process the front flippers are severed from the trunk and follow the sculp, but are then removed and salted for later use of the meat for human consumption. Also the large fillets of meat from the back are cut off, particularly from younger animals, and frozen or salted for later human consumption. Sculps are chilled overnight in the sea, and brought back intact to mainland factories, where machinery removes the blubber which may then be exploited for various purposes, while the fur is processed, and used in the production of clothing.

STUNNING AND KILLING PROCEDURES

Firearms

Regulations

Rifles of different calibres with optical sights are the main first weapons. It is mandatory that the rifles are inspected and approved by a gunsmith before departure and sighted in with the ammunition that is to be used during the hunt.

The prescribed ammunition used for pups is similar to that which is prescribed for the hunting of smaller terrestrial game animals (roe deer, fox, etc.) This is soft-nosed, expanding bullets with impact energy of minimum 981 Joules (100 kgm) at 100 m (calibre .222 and higher).

The prescribed ammunition for 1+ seals is similar to that used for hunting large terrestrial mammals (moose, red deer etc.) This is soft-nosed, expanding projectiles with impact energy of at least 2700 Joules (275 kgm) at 100 m for 9 g bullets, and 2200 Joules (225 kgm) at 100 m for 10 g bullets (calibre 6.5, .308, and higher)

The seals are to be shot in the head (brain).

Basic effect of rifle shots in the brain

Many factors influence the effectiveness of a rifle bullet, including the speed, weight, shape and design of core and jacket. A heavy projectile will generally penetrate farther into tissues than a lighter one. The projectile's impact energy, which is the relationship between the projectile's speed and its mass and its sectional density (SD), which is the relationship between the weight and the cross-section of the projectile, also has an important effect on the projectile's penetration abilities and tissue damage potential. A general rule is that the higher the impact and SD, the better penetration and the greater tissue damage.

A full-jacketed projectile consists of a soft core of lead or a plumbiferous alloy, surrounded by a capsule (jacket) of hard metal. The projectile nose can be pointed, rounded or butt. A full-jacketed bullet is designed to penetrate solid objects without being damaged or deformed, and the traditional, pointed bullets are primarily used for military purposes, while round-nosed, semi-round nosed, and butt bullets are used for the hunting of large and/or dangerous game animals. For hunting conventional terrestrial game different types of soft-point or whole metal bullets are usually preferred. In general, these consist of a soft core of leaden material surrounded by a hard metal jacket, which is enclosed at the rear and open at the front, exposing the soft core.

When soft-pointed or similar bullets hit an object, the jacket is torn open as the soft core is compressed and expands at penetration, changing the projectile into a mushroom-like shape and creating a wide wound canal. In addition to the tissue damage along the wound canal, the expanded projectile causes violent shock and pressure waves, and generates complex pressure changes in the surrounding tissues, as the energy is transferred (Harvey *et al.* 1962, Amato *et al.* 1974, Berlin *et al.* 1976, Charters and Charters, 1976, Bellamy and Zajtchuk, 1990). This results in the creation of a permanent, localized tract as a result of laceration and crushing of tissue, and in addition, high radial forces imparted to the parenchyma produce a large temporary cavity that exists for only microseconds. In organs which have no room for expansion, the sudden energy transformation causes an almost explosive rise in pressure (Bellamy and Zajtchuk, 1990).

The brain is non-elastic, and, in addition, is enclosed by rigid bones, which provides no opportunity for expansion (Bellamy and Zajtchuk, 1990, Finnie, 1993). Therefore, the brain is particular vulnerable, and missile wounds to the skull and brain are often grossly destructive (Clemedson *et al.* 1973, DiMaio and Zumwalt, 1977, Finnie, 1993, Karger *et al.* 1998, Øen and Knudsen, 2007). When a bullet at high velocity passes the brain, or is in close vicinity, the inside pressure will increase dramatically and the damage may be 'explosive' (Watkins *et al*. 1988). The whole brain, or parts of it, might be blown away, (often named 'Krönlein' shots after Krönlein, 1898; Betz *et al.* 1997; Thali *et al.* 2002), or pressed through natural openings such as the sinuses or the *foramen magnum* (Harvey *et al*. 1962). The cranium might crack, and fractures and bone splinters may cause secondary injuries to the brain tissue (Bellamy and Zajtchuk, 1990, Thali. *et al.* 2002).

In common minke whales (*Balaenoptera acutorostrata*) that were euthanized using a rifle and round-nosed full jacket bullets (Øen and Knudsen, 2007) when a projectile penetrated the cranium near the brain, or in the upper cervical spinal canal, extensive gross intracranial haemorrhages were documented as a general phenomenen, as well as displaced skull fractures. The brainstem and central areas of the brain were frequent sites of haemorrhages, and vascular injury in these significant areas is likely to cause serious and immediate effects ('brain stem effects') as described in other studies (Crockard *et al.* 1977a, 1977b, Levett *et al.* 1980, Carey *et al.* 1989, Karger *et al.* 1998).

Research on rifle shooting of seals

A limited number of studies is available from Norwegian seal hunts which investigates how effective rifles are with respect to killing effort of young and adult seals, and the proportion of seals that are killed instantly, or survive the first shot and escape wounded or die later from their injuries.

Øen (1995a) made a study of weaned pups that were shot with rifles of calibres .222 and .223 using commercially-available, soft-point ammunition of 50 grains (gr), with a muzzle velocity (V_0), and impact energy at 100 m (E_{100}) of 957 m/s and 1020 J, respectively for .222 and 55gr with V_0 and E_{100} of 987 m/s and 1246 J, respectively for the .223. The inspector, a trained veterinary officer, controlled the shooting, the individual seal's reactions to the shot, and assessed the skull damage by palpation on the spot before skinning. The heads with neck, and also torsos from every tenth pup shot, were collected and brought back for laboratory inspection and evaluation of the bullets` performance. The results of the gross pathological examinations were compared with the inspector's report from field.

The results showed that out of 349 shot pups, 165 had been shot with calibre .222, and 184 with calibre .223. The head or upper neck had been hit in 302 seals (86.5 %) of which six had

been hit outside the brain. Two of these were judged to be still alive at inspection. Thirty six (10.3 %) were hit in the neck and all these were dead at inspection. No seal had escaped wounded.

Thirteen (3.7 %) pups were hit in the thoracic region, of which four were still alive at inspection. Based on the seals` reactions at being hit, and the gross examination which included inspection of the carcasses and palpation of the skulls on the ice, the inspector concluded that 343 (98.3 %) of the seals had been rendered instantly unconscious or dead. Two of the 338 seals hit in the head and four of the 11 seals shot in the thorax were judged to be alive and were immediately struck with hakapik (in total 6 out of 349). "Swimming movements" were registered in 21 (6 %) of the seals that were judged to be dead from the rifle shot. The post-mortem examination in the laboratory of one of these cases (No. 166) showed that most of the cranium had been shot away and almost emptied of brain tissue.

The shooting range varied between 10 to 40 m, with an average of 30 m. The total number of rounds used for the 349 pups was 418, of which 384 had hit the seals. The extra rounds were mainly fired at the seals previously hit in body outside the neck and skull (34). Some of these had obviously not been rendered unconscious from the first bullet.

The 35 samples of heads underwent gross examination in the frozen state before being split along the midline with a saw. The cut was carefully cleaned, and the brain injuries and haemorrhages (if parts of the brain were still present) examined and photographed. These examinations demonstrated that when the bullets had hit in the brain or in the close vicinity of the brain, the skull bones (*Os occipitale, O. parietael and O. frontale*) and the bones at the brain base were severely injured and in many cases completely crushed and the cranium emptied of brain tissue. Massive haemorrhages were seen at brain base and in the meninges from hits in the skull, the neck, and even in the vertebrae in the thoracic region. No significant difference was demonstrated between the two calibres.

Daoust *et al.* (2002) reported the results of observations made by representatives of the Canadian Veterinary Medical Association during the Canadian coastal hunts in 1999 and 2001. The main conclusion was that the large majority of seals (98 %) taken during these hunts were killed in an acceptably humane manner.

At the Front (northeast of Newfoundland) in 1999 (Daoust et al. 2002) the seals examined were shot from vessels or small speed boats, and most were dead by the time the observers arrived on site. Of 47 carcasses examined, 35 (75 %) had been shot in the head. The skulls and brains were completely destroyed in 28, the mandibles and cranial cavity bases were destroyed in five, and the snouts and frontal regions of the cranial cavity were destroyed in two. Six that had been shot in the neck had complete transection of the cervical portion of the vertebral column. Three animals had been shot in the ventral region of the neck with destruction of soft tissues, including major blood vessels, but no bone fracture. Two of these animals were seen by the observers as they were shot. One appeared to die instantly because it immediately stopped moving, and only its tail was twitching when it was brought on board, several seconds later (in Canada the hakapik is not used before bleeding in rifle shot animals). The other was seen from a distance; it showed some convulsions after being shot and fell off the ice floe into the water. It was dead and motionless when retrieved a few minutes later. The remaining 3 (6 %) of the animals had been shot in the thorax or abdomen; one of them was found alive on an ice floe.

Daoust and Cattet (2004) also compared the damage to the skulls of beaters caused by .22-magnum rimfire cartridges with that from 22-250 centerfire cartridges. They found that 22-250 cartridges are powerful enough to completely destroy the head of a beater, and thus mere visual inspection would be sufficient to verify the animal's death. They also found, by using

intact heads of beaters under controlled conditions, that less powerful ammunition like calibre .22 magnum might be sufficiently powerful to kill beaters in a humane manner when they are hit directly in the brain case from a distance of 40 m or less. However, the conclusion was that compared with ammunition of higher power, it may be more likely to injure a beater than to kill it instantaneously when hit elsewhere than in its brain case, and that a precautionary approach would suggest that this type of ammunition should not be allowed during the harp seal hunt.

A recent investigation (August 14, 2007) was conducted in Vasa, Finland, with shooting trials of heads, torsos and carcasses of grey and harbour seals (1+) with .222Rem, .243Win, .6,5x55 SE, .308 Win calibre rifles plus two smaller calibres (.17HMR and .22 Win Magnum) not permitted for seal hunting in Scandinavia and Finland. The bullets used were soft-pointed (Sako Gamehead SP), Polymer tipped Varmint (Hornady V-Max and Nosler BST) and Winchester-jacketed hollow-point (JHP). The shooting range was 50 m. (Øen EO, Pellas S and A. Storm. unpublished, Report available in October 2007).

The heads and/or necks were targeted from the side. Only one was targeted from the front and in one case it was shot in the thorax. Each head was autopsied consecutively with suitable equipment and tools, including wooden probes, knives, bone saw etc. A cranium of a grey seal was used as a guide and for the comparison of anatomical structure.

The first step of the autopsy was a careful investigation with the wooden probe to check and measure the penetration depth without destroying the wound canal. The dissection of the wound canal started at the entrance wound by carefully slicing blubber and tissue following the probe into the wound canal to demonstrate the canal in its full length including any crater formation, fractures of bones and possible projectiles remains. The wound canal was described in a protocol and further documented by photographs.

A detailed report of this study is still in preparation; however, one conclusion can already be drawn from the trials. All bullets tested in this trial cracked the skull bones on hitting the skull, and in many cases the head was completely destroyed, with the bony parts completely transected and held together by the skin.

The Varmint hunting bullets appeared to be the most effective. These bullets are intended to disintegrate violently upon impact with the target, and are therefore usually light-weight and have very thin jackets. The dramatic fragmentation of the bullet is achieved from a combination of the copper jacket, the special core design and the polymer tip. Upon impact, the tip acts as a “wedge” and pushes backwards into the bullet core. The hollow cavity right behind the base of the tip allows the tip to build up kinetic energy before smashing into the largest part of the core. This ensures instant fragmentation even at low velocity, in long range shooting situations. Varmint bullets have good aerodynamics and high ballistic coefficients, and are therefore very accurate.

Some advantages of using a rifle for the stunning/killing of seals

There are several advantages of using a rifle as first weapon in sealing.

In the Norwegian hunt, most seals are either shot from a stand in the bow of the main boat, which under normal hunting conditions is a very stabile position, or they are shot from a stand on fast ice. Some, however, are shot from the dinghies, which are not particularly stable. However, with modern rifles it is possible to re-shoot the animal very rapidly, if necessary.

Modern optical sights are used, often in combination with a rangefinder and silencer, and can ensure high accuracy on shooting ranges from a few meters to 100 m from a stable platform.

Therefore, the seals can be shot at relatively long ranges, essentially without and disturbance, distress or awareness of any threats. The rapidly expanding ammunition used has a grossly destructive effect on the brain, causing immediate or very rapid death, and also is greatly destructive with hits outside the brain. Shots through the upper part of the neck will usually completely transect the spine, causing immediate or very rapid death due to major damage to the spinal cord and brainstem, and by severing blood vessels to the brain (Øen 1995a; Daoust *et al*. 2002; Øen and Knudsen 2007). Also shots through soft tissues in close vicinity to the brain, or in the neck, cause bleeding and tissue disruption in higher and vital areas in the central nervous system resulting in instant unconsciousness and death (Daoust *et al.* 2002; Øen and Knudsen, 2007).

Disadvantages of using a rifle for the stunning/killing of seals

There are disadvantages from the use of firearms in the hunt. The risk for bad shots (i.e. stray-shots or hits outside vital areas) is present and increase with longer shooting ranges (>50m) and/or if the boat (platform) is moving heavily or the ice floes are in motion in bad and windy weather conditions. The seal might also suddenly move its head. In such situations, the shot might either miss completely, or wound and injure the animal. Seals shot and wounded might escape before they are re-shot.

There are no official statistics on numbers or percentages of seals struck and lost, either alive or dead during Norwegian hunts. However, national inspectors have been on board each vessel since the early 1980s and in some seasons the hunt has also been observed by international observers from the North Atlantic Marine Mammal Commission (NAMMCO). Based on the inspectors'annual reports, the number of such "struck and lost" events seems to be very low. The response from the inspectors when interviewed is that "some animals escape wounded or dead each year, but the number is very small" (Øen, Pers. comm.).

In a "NAMMCO workshop to address the problems of "Struck and lost" in seal, walrus and whale hunting" (NAMMCO 2006), it was reported that the only estimates of struck and lost rates available to the workshop were from a recent questionnaire survey covering the Greenlandic open water hunt, from estimates from the vessel hunts for harp seals at the Gulf of St. Lawrence and Front (Sjare and Stenson 2002), and from estimates on the grey seal hunt in Finland. Based on hunters´ own experiences and observations, the workshop found that the proportion and number of "struck and lost" was likely to be very low in vessel-based hunts and in ice hunts for harp and hooded seals. However, in open water hunts this has been reported to be high (NAMMCO 2006). Open water sealhunts are prohibited in Norway.

Hakapik

Regulations

The hakapik is a metal ferrule that weighs at least 400 g, usually with a blunt projection (hammer), with a maximum length of 4cm. Opposite the hammer, the ferrule has a slightly bent, sharp spike of between 12 and 18 cm in length. The ferrule is attached to a wooden shaft of between 110 and 150 cm lenght.

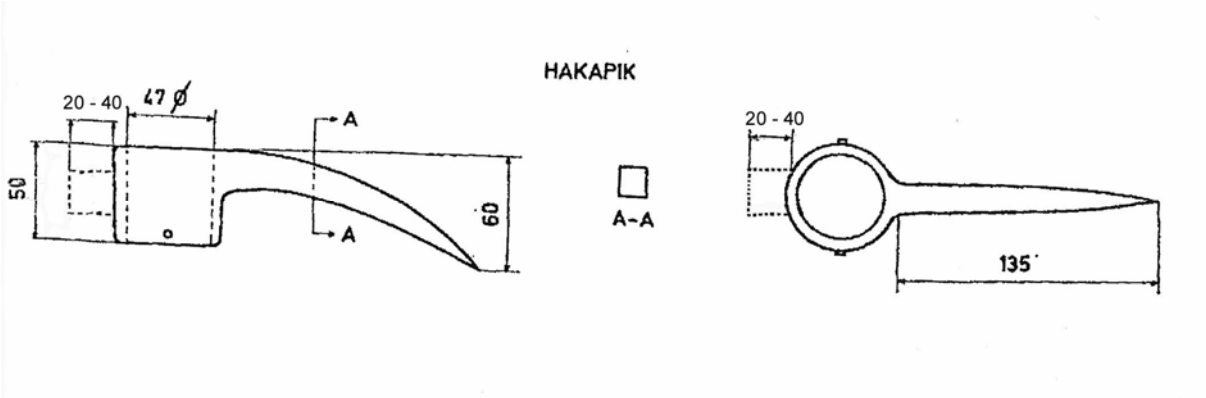

Figure 10. Schematic drawing of Norwegian hakapik.

Figure 11. Norwegian hakapik. The tip at the top of the shaft is used when the hunter is walking on the ice.

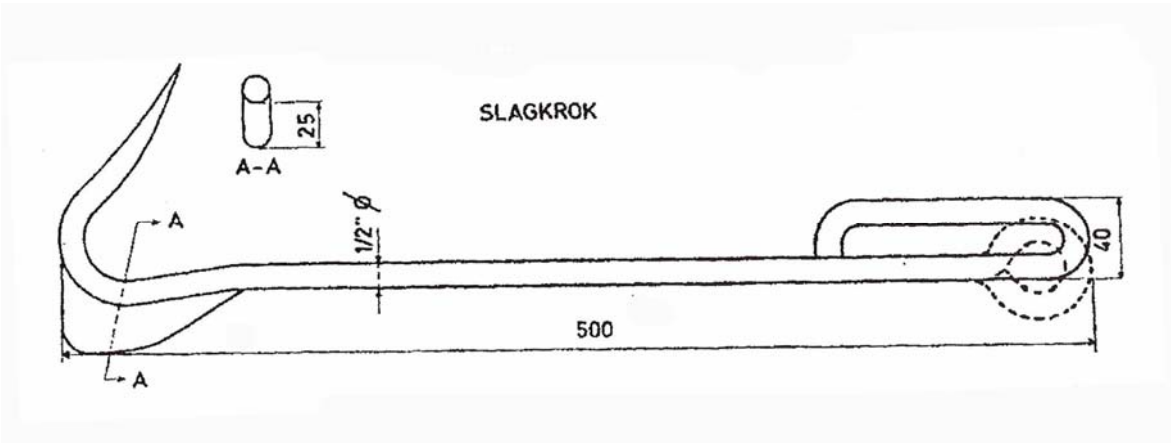

Figure 12. Norwegian slagkrok used for pups.

The slagkrok is modified version of the hakapik. It is an iron club, 50 cm long, with a sharp spike opposite the club. It weights a minimum of 1 kg, of which at least 250 g is accounted for by the head next to the spike.

The hakapik is only permitted as first weapon to stun/kill (weaned) pups and is not considered a suitable weapon for the stunning or killing of seals over 1-year old because of their thicker and stronger skulls. Use of the sharp part of the hakapik, the spike, is, however, mandatory after all seals have been shot with the rifle.

Weaned pups are permitted to be stunned using slagkrok. As with the hakapik, two blows are mandatory, both directed to the skull over the brain. The first blow is given with the blunt projection of the tool, and as with the hakapik, followed immediately by a blow with the spike. Use of the slagkrok is banned for seals over 1-year old.

Basic effect

The blow with the hakapik or slagkrok is aimed at the top of the skull, over the brain (calvarium). The first blow to pups is with the blunt projection on the tool and this is immediately followed by a blow with the spike, which penetrates deep into the cerebrum and the basis of the brain (or through the skull base).

The first blow, using the blunt part of the instrument is intended to cause concussion and loss of consciousness from multiple fractures and crushing of the skull roof. Experience shows that due to their thin skulls, when properly used, the initial blow from the hammer renders the seal pups unconscious, probably due to concussion, brain damage and fractures in the skull base. The spike is used to ensure the persistence of the state of irreversible unconsciousness by causing further damage and haemorrhages in the brain structures before the seal is bled (much similar to “pitching” which previously was used after stunning with the captive bolt pistol in slaughter animals).

The reason for striking the animal with the hakapik spike also after it has been shot is the same. The procedure must be followed, even if the skull and brain has been completely destroyed from the rifle shot.

Today the hakapik is less frequently used as the first weapon than previously because today`s hunts are more focused on weaned and more mobile pups. During such hunts, most pups are shot from the main boat. According to the information given by some inspectors, on some boats in some seasons, almost 100 % of the seals are now killed by shooting (Øen, Pers. Comm.).

Research on the use of hakapik

Data on stunning of seals with the hakapik that is used in the Norwegian hunt are very limited. Only one study seems to be available on the stunning/killing ability of hakapik used under controlled conditions. Blix and Øristland (1970) showed that a single blow to the head of three conscious young hooded seals with the blunt part of slagkrok produced immediate and irreversible disappearance of brain activity, as recorded by electroencephalogram (EEG). They also showed that respiration continued for several minutes in two of the pups that were not bled subsequent to stunning, while cardiac activity persisted between 30 and 56 min in all three animals. The maintenance of respiration probably reflects the fact that the brainstem (in which the neural circuits that control respiration are located) remained intact after stunning with the blunt end of the slagkrok. Since cardiac activity continued and the two animals were

not bled, these neural structures continued to receive a blood supply and maintained functional integrity for some time after death. This is equivalent to that which has been described when stunning cattle with a captive bolt pistol (Gregory 1991). From their research Blix and Øritsland (1970) concluded that a blow to the head with the slagkrok represented an effective method of killing young seals, and that there was no association between conscious life and *post mortem* muscle activity.

Data from the field on the killing ability of the hakapik during the Norwegian hunt seem not to exist except general reports from the national inspectors. In the Canadian hunt, both the hakapik and a club without a spike are used as the first weapons. However, the Canadian hakapik is somewhat lighter in weight than the Norwegian version. Additionally, the blunt part of the hakapik, the hammer, is usually shorter (max. 2.5cm) or is lacking. Also, Canadian regulations do not demand use of the spike after the blow with the blunt part of the hakapik. The club used in Canada is not permitted for use in Norway. In the Canadian hunt, the seals are not usually bled on the ice but are hoisted onto the deck before bleeding. Thus, the findings described by Daoust *et al*. (2002) are not completely comparable to the Norwegian hunt. There are, however, several reports of the use of the hakapik and club in the Canadian hunt in which the proportion of skulls that had fractures have been studied by palpation of the skulls in the field.

Advantages of using the hakapik for the stunning/killing of seals

There are some obvious advantages of using the hakapik as the first weapon for the stunning/killing of young seals. The hunters come very close to the animal and therefore the blow can be directed very accurately, thus, the risk of missing the vital area is small. Also the blow can be very rapidly repeated (within 1 second) if the hunter is uncertain about the effect of the initial blow. When using the hakapik, the whole killing process can be performed very rapidly, as bleeding out can be performed immediately after the blow with the hakapik spike.

When using the hakapik, the risk of seals escaping wounded are negligible.

Disadvantages of using the hakapik for the stunning/killing of seals

The operator (hunter) must be well-trained to hit a relatively small and possibly moving target with accuracy. It is also important to emphasize the possibility that the seal retracts its head in the moment the blow is given. Therefore, the way in which the hunter approaches the seal is very important.

Bleeding

The seals are bled on the ice immediately after they have been shot and struck with the spike of the hakapik.

To start the bleeding out, the seal is turned onto its back and a cut is made from the underside of the jaw to the breastbone, followed by cuts into the armpits, cutting the *Arteria brachialis* on both sides. Simultaneously, other large severed vessels in this area are also cut contributing to the blood loss. This is probably the most rapid method of exanguination that can be used by hunters in the field. The reason is that *A. brachialis* is easy to find, and blood pressure is rapidly lost upon bleeding due to the large vessel dimension and their close connection to the aorta: Most pinnipeds have a distinct dilatation or enlargement of the aortic arch as compared with terrestrial animals. The large branch that runs from the arch and up along the neck is

paired into two carotic artery branches. These run on both sides of the trachea and higher up they are divided into several arteries that supply the head and brain with blood. In the aortic arch, a large branch is also given off and supplies the forelimbs as well as the cervical vertebra with blood. The cervical vertebral arteries supply the spinal cord and also the brain with blood in addition to the carotid arteries (NAMMCO 2004). It is these arteries to the forelimbs that are cut when seals are bled by making incisions in their armpit. In adult seals the distance from the aortic arch to where the brachial arteries are cut during bleeding is only about 10cm. After cutting the arteries, the blood pressure drops rapidly, as indicated by cessation of pulsatile flow within 10-15 seconds.

5. CRITERIA FOR SUCCESSFUL KILLING

GENERAL ASPECTS

Official criteria of death have not been established for most species, except for the adoption of criteria of death in man and whales (Knudsen 2005). In a report on euthanasia by the American Veterinary Medical Association (AVMA) the criteria to determine death in animals are dealt with in a very generalized manner: "Death must be confirmed by examining the animal for cessation of vital signs, and consideration given to the animal species and methods of euthanasia when determining the criteria for confirming death" (AVMA Panel on Euthanasia, 2001). For many species and activities, including most forms of hunting, the irreversible cessation of the circulatory and respiratory system is regarded the criterion of death (Knudsen 2005). In slaughter animals technical death has been defined by Blackmore and Delany (1988) as "irreversible insensibility due to cerebral anoxia, usually due to severance of either common carotid arteries or the vessels from which they arise". However, in slaugther animals the moment of death is regarded less important than the moment of insensibility, i.e. when the animal no longer responds to painful stimuli. In many countries the killing of slaughter animals therefore consists of a two-step process: stunning and bleeding. The EC Council Directive 93/119 (Anon, 1993) defines stunning as "… any process which, when applied to an animal, causes immediate loss of consciousness which lasts until death". In Norwegian seal hunt the stunning procedure itself is likely to also cause immediate death in most cases.

COMPARATIVE ASPECTS

Terrestrial hunting

A wide range of terrestrial wildlife species are hunted worldwide using an extensive variety of methods and gears. The weapons and ammunition used in different hunts in different countries and regions vary considerably, depending on a range of factors. These include animal species and size, hunting habitat and environmental conditions, hunting and killing efficiency (which in some circumstances may be contradictory or conflicting), cultural traditions, legislation, animal welfare considerations, economy and commercial availability, personnel safety, personal experiences and preferences, etc.

According to the European Federation of Hunters (FACE), sport hunting is a widespread activity that engages more than 7 million hunters in Europe and is of considerable economic and social importance (FACE 2007). Many different species are hunted in large numbers. In the context of comparing seal hunts with other hunts, the big game hunt of different large deer species must be regarded the most relevant, as rifles shooting expanding ammunition are the most widely-used weapon for big game in Europe, and therefore is comparable to the methods employed in the Norwegian seal hunt, although several European countries also allow the use

of smaller firearms, like shotguns, and also bows and arrows, to hunt big game (FACE 2007). In the UK alone, for example, more than 250000 deer are hunted each year (Anon 2000) and in Norway in 2006/2007 hunters felled about 65000 terrestrial big game and 29000 roe deer (Statistics Norway, 2007).

Generally, the legislative demands for big game hunting in Europe vary greatly from country to country. Some countries have set minimum requirements for hunters (training, licensing, etc), weapons (minimum calibre), and ammunition (type, weight). In Norway, theoretical and practical training and exams (shooting tests) are mandatory in order to hunt, and species-defined minimum technical requirements for weapons and ammunition have been set for all species hunted, and included in the federal hunting legislations (see Addendum). A similar situation is in place in several EU countries, while other EU members only have regional regulations defining such requirements, and some countries (e.g. UK) appear to have no requirements for demonstrating the hunters` competence nor specifications for either weapons or ammunition for the different species hunted (Knudsen 2005, FACE 2007).

The most widely method used to hunt animals is with a gun, and the animals are normally shot at a certain range and are therefore not in the immediate reach of the hunter. Therefore in most hunting situations assessment of whether an intended kill has been successful or not is often based on a combination of an evaluation of the hit point and whether this is likely to have caused fatal damage, and on the animal`s behaviour. As approaching a potentially conscious, wounded wild animal to check its pulse, respiration or reflexes might sometimes be very hazardous and even dangerous. Total immobility is therefore often used as an indicator of death. “The animal fell on the spot” is a common way of expressing this among hunters when describing a well-placed shot. However, it is not unusual for an animal to move a certain distance having been shot, even when the projectile fatally damages vital organs and insensibility commences rapidly (e.g. moose, *Alces alces*, might run several hundred meters after being shot in the heart). The hunters will usually wait a few minutes after the first shot before approaching the animal (Øen 1996).

Recommended and good shooting practice when shooting terrestrial big game with a rifle is to aim at the animal`s chest with the intention of inflicting fatal injury to the lungs and/or heart, and/or greater vessels, so that the animal dies from loss of blood and the drop in blood pressure (Gjems et al. 2003). Generally, the brain is not usually a preferred target as it provides a considerably smaller target area, and therefore there is a potential higher risk of only wounding the animal. If an animal that has been hit with rifle still moves (whether coordinated or not) recommended practice is to euthanize it with a shot to the upper neck/brain.

The area of impact of the first round will almost always be decisive with respect to the speed with which the animal collapses and dies. Even though it is often possible to fire a rapid volley of shots, the risk of missing the vital areas will increase if the animal starts running, and there is limited time to take proper aim (Øen, 1995a). If a wounded animal escapes the first hit all reasonable attempts should be made to locate it in a proper manner. In the big game hunt when retrieving a wound animal, it is common practice not to start searching for the animal until after about an hour has elapsed in order to give the animal time to calm down and become weaker from loss of blood and impaired function (Øen 1995b, Øen 1996).

Despite the fact that hunting big game with rifle is a widespread practice in Europe (and elsewhere) and millions of big game are hunted annually (for review see e.g. Knudsen 2005), little scientific data are available on the killing efficiency of the methods and weapons in use, nor on animal welfare concerns associated with these hunts. Data from meat inspection in Sweden and Norway (Hässler, 1963; Paus, 1965) in the 1960s showed that 65-68 % of the

shots had probably resulted in rapid death. However, Øen (1995b) reported results from moose hunting in the 1990s that indicated that only 21 % of hunted moose lost consciousness and died instantly or very rapid. The killing efficiency in his study was based on *post mortem* investigation, testing of the corneal reflexes and behavioural observations. If the animal fell out of the hunter's sight, the time to death was estimated according to the distance the animal had covered before collapsing. In a study on night shooting of wild impala shot in the head (Lewis *et al.* 1997) it was reported that 93 % of the animals were killed instantaneously. This hunt was carried out at night under artificial light, and the head was the preferred target. Unfortunately it is not stated how animals were evaluated as instantaneously dead. Despite the apparently good results this method should not be recommended as it may result in a considerable number of animals being wounded and not retrieved. In Norway such hunting practices are forbidden.

Pre-killing stress in most hunted free-living animals is probably very minor (both in duration and severity) as most hunting is in the form of stealth rather than chase. Stealth probably egenders minimal stress in the animals before shooting, as in many cases the quarry will be unaware of the hunter. Exceptions include when hunting dogs are used to drive or chase the animals (White *et al.* 2003).

Comparative knowledge from slaughter animals

A significant problem when comparing hunting with the slaughter industry is that during most hunts the killing of the animals is a one-step-process whilst in slaughter animals the killing is divided into several steps including stunning (or anaesthesia), sticking and bleeding (see below). The techniques suitable for killing domestic animals are seldom applicable to wild animals, or to animals that are unaccustomed to being enclosed or handled by people. The hunts of ice-breeding seals in Norway and Canada are probably the only wildlife hunts in the world in which slaughterhouse-like methods have been employed.

Also, when hunting is compared with the killing of animals during industrialized slaughter, usually only the killing process is addressed. However, stresses imposed prior to the actual killing process should also be taken into consideration. Several authors (Leach 1978, Grandin 1980, Harrison 1984, Blackmore 1993, Albert 1993, Øen 1995b, 1996) have emphasised that the actual killing of a slaughter animal is the final step in a prolonged procedure that starts when the animal is taken from its familiar environment, and continues with loading, transportation (often over considerable distances) and reloading at the slaughter plant. Research on the effects on long transports of slaughter animals have particularly focused upon the negative effects on meat quality (Gade and Christensen 1998, Nanni-Costa et al. 1999, Maria et al. 2003, Villarroel et al. 2003) but it is also well known and documented that transport, loading and unloading, temporary housing in unfamiliar surroundings and handling and restraining prior to killing, may impose considerable welfare problems and stresses upon the animal (Grandin 1980, Jago *et al.* 1997, Geverink *et al.* 1998, Pérez *et al.* 2002). It has also been reported that animal stress before slaughter may change amino acid neurotransmitter release, which may influence on post-stun unconsciousness (Cook *et al.* 1992, Manetca 1998).

The assessment of the state of unconsciousness and insensibility after stunning can theoretically be obtained either by observing behavioural signs (the presence of voluntary motor activity and the presence or absence of reflex reactions), by recording electroencephalographic activity (EEG) or by *post mortem* investigations on the severity of trauma produced. In recent decades, the results obtained from basic and applied research on stunning and killing methods for slaughter animals have led to changes in legislations

particularly related to pre-slaughter stunning (reviewed in Knudsen 2005). Animal welfare concerns have not solely been the reasons for these changes. The constantly increasing demands for efficiency in industrialized slaughter plants, as well as a growing awareness of the deleterious effects that poor techniques have on on meat quality, have also been as important (Rose *et al.* 1991, Fletcher 1999, Thaler 1999). Moreover, other factors such as food hygiene requirements and safety and working conditions for the slaughtermen, have also had an impact on the killing and slaughtering procedures employed for different species (Blackmore 1993, Anon 1989).

In recent decades brain function has extensively been studies by means of EEG in experiments to evaluate the effect of different stunning techniques (electricity, bolt pistol, gassing) on the most common slaughter species (for review see Knudsen 2005). With respect to comparison with aspects of the seal hunt, the stunning of animals with the captive bolt is probably the most relevant (as compared with electricity and CO_2 gassing). EEG-studies of captive bolt stunning (e.g. Daly et al. 1987, 1988) have shown that if the bolt is placed correctly, shooting produces both delta and theta waves, tending to an iso-electric line on the EEG. It is assumed that the animal is unconscious by analogy to similar EEG changes described in man. However, evaluation of a mechanical stunning procedure using EEG may be problematic as the blow to the head may disturb the recordings or destroy the electrodes. Neuropathological studies of the captive bolt (Finnie 1993; 2000; Finnie *et al.* 2002) have shown that, based on the neurotrauma produced, such stunning should immediately be followed by further action (sticking) to ensure that the animal is rendered permanently unconscious. The penetration of the bolt is not the primary cause for loss of consciousness. It is the energy that is delivered to the animal's head that is most important (Daly and Whittington 1989). Incorrect positioning may fail to produce unconsciousness, and shooting in the frontal position is considered the most effective and the only acceptable method for cattle, swine and horses. In cattle it has been shown that if the site of stunning is more than 4-6 cm from the ideal position, the stunning efficiency is reduced by 60 % (Daly, 1987). In a study of stunning efficiency in UK abattoirs in the 1990s it was reported that 94 % of the cattle were stunned instantaneously, while the equivalent number for pigs was 80 % (Daly and Whittington, 1992; Anil and McKinstry, 1993). However, it was also reported that as many as 53 % of young bulls had to be re-shot twice or more before they were declared unconscious (Daly and Whittington, 1992). Grandin (1998) reported that of 11 federally inspected beef plants in the USA; only 4 were able to render 95 % of the cattle insensible with a single shot.

According to a recently issued Norwegian report (Mejdell and Lund 2007) inadequate stunning when using the captive bolt is reported to be an increasing problem and many factors regarding the efficiency of the captive bolt still need sto be investigated, including ammunition (patron), adequate air pressure, correct placement of the bolt and shooting angle (Mejdell and Lund 2007).

Millions of animals are slaughtered every day in Europe and with such a large-scale industry there is little room for individual consideration of each animal and both the technology and the regulations have been adapted to meet the requirement of a high-tempo process and it is not possible to accomplish a sophisticated monitoring system to measure brain activity in individual animals. In practice, therefore, the effects of stunning are judged by much simpler methods. According to Blackmore and Delany (1988) the traditional reflexes used to judge the depth of chemical anaesthesia are of little relevance to the slaughter process, except for with CO_2 anaesthesia. When an animal is stunned by a physical method, absence of spinal reflexes is not an indication of insensibility. Instead, the occurrence of convulsion is regarded as a reliable indication that the animal has been properly stunned (Blackmore and Delany, 1988; Gregory, 1991). Indicators of successful captive bolt stunning are that the animal

should immediately collapses and do not show normal rhythmic breathing (Blackmore and Delany, 1988). The muscles of the body are contracted and the back is usually arched, and kicking may be seen after the initial muscle contraction phase. Effective stunning produces relaxation of the jaw and consequently the tongue will hang out when the animal is hoisted (Gregory, 1991). The head should be completely relaxed, the ears should drop, and the eyeballs have a fixed position. It is often impossible for the captive bolt operator to test eye reflexes routinely because the animals fall down and are convulsing.

After electrical stunning, pedal reflexes have been observed for more than two and five minutes in sheep and cattle, respectively (Blackmore and Newhook, 1982), and may be intensified if the animal is handled, which can cause problems in terms of carcass restraint and worker safety (Blackmore and Delany, 1988). Palpebral reflexes, which are not under cortical control, may be present in an electrically-stunned animal and have been recorded in sheep and cattle for up to 200 and 400 s after exsanguination, respectively. In the case of ineffective electrical stunning, the reflex can be inhibited while the cerebral cortex is still functional, and the animal may be sensible (Blackmore and Delany, 1988). The presence of a corneal reflex indicates physiological brain stem activity and not cortical function, and consequently, it does not accurately distinguish between consciousness and unconsciousness (Anil, 1991); and it has been evoked in calves for up to 44 seconds after the EEG has become iso-electric (Blackmore and Delany, 1988). Blackmore and Delany (1988) reported that in animals stunned by percussive methods there were no correlation between the extent of cranial damage and the loss of corneal reflexes. Also the pupillary reflex has been considered to be of little value after slaughter, because the process interferes with the blood supply to the retina (Blackman *et al.* 1986). In an animal stunned by the captive bolt, the heart can carry on beating for many minutes, but proper stunning will eventually cause both breathing and heartbeat to stop (Gregory 1991, EFSA 2004).

Registration of respiration or rhythmic breathing is widely used as a criterion to judge the effect of both percussive and electrical stunning in slaughter plants (Blackmore and Delany 1988, Gregory 1991, Grandin 1994). However, as with the corneal reflex, the cessation of respiration does not necessarily correlate with the extent of cranial damage produced by percussive stunning methods (Blackmore and Delany, 1988). Respiration normally ceases during the tonic phase of a physical stunning process, but usually returns as periodic respiratory gaps, which have been recorded in cattle and sheep for up to six minutes after stunning (Blackmore and Delaney, 1988). Wotton and Sparrey (2002) reported that identification of rhythmic breathing movements in ostriches after stunning was difficult because spinal reflexes produced contraction of limb muscles, which resulted in almost rhythmic body movements that could easily be confused with breathing movements. Walking movements are usually considered as a sign of sensibility, but this is not an absolute criterion. It may be seen even when the head has been separated from the body ('the running headless chicken'), and muscular contractions and spasms are common long after animals have been bled and died.

6. INSPECTION AND OBSERVATION

Norwegian seal hunting is subjected to detailed regulations concerning hunting seasons, quotas, methods of slaughtering, instructions and training of seal hunters, and approval of vessels. The rules and regulations are laid down by the Ministry of Fisheries and Coastal Affairs. The Directorate of Fisheries enforces the regulations. The regulations concerning

killing methods and animal welfare are discussed with veterinary authorities and special consultants before they are enacted and the Directorate of Fisheries employs inspectors to be present on board every sealing vessel during the entire season in order to ensure compliance with the regulations.

The inspector is a veterinary surgeon or trained fisheries inspector and reports directly to the Directorate of Fisheries. Before leaving the harbour at the beginning of the hunting season the inspector ensures that the sealers have passed the required tests, and checks the licences and the hunting equipment. During the hunt, the inspector is present on the deck or the ice, and controls the killing process. If minor deviations from hunting regulations are observed, the inspector asks the captain of the vessel for these to be corrected. If a more serious matter arises, or if the deviations are repeated, the inspector communicates directly with the Directorate of Fisheries on how the situation should be handled. At the end of the season, the inspector makes a written report to the Directorate of Fisheries together with a general evaluation on how the sealers have performed. Deviations from regulations are reported to the Directorate on specific forms. The captain of the vessel is informed of the content of the report submitted and may be asked to present himself at the Directorate to answer questions, particularly if the inspection reports gives the authorities reason for further investigation. If it is established that rules or regulations are violated, the captain will be penalized. The directorate could fine the captain for less serious violations. If the violation is graver, the captain will be prosecuted.

All the information from the sealing season gathered by the inspectors and the Directorate is reported to the Marine Mammal Advisory Board, and discussed in the Board. The members of this Board are representatives of the fisheries authorities, the sealers and the processing industry. Scientific advisors and observers from several Ministries and non-governmental organisations (NGOs), are present during the Board meetings. All the experience thus obtained by the Board serves as background for the advices given to the Ministry of Fisheries by the Board on amendments and improvements to the current regulations.

Concerning observation, the North Atlantic Marine Mammal Commission (NAMMCO) has a programme for international observation of the hunt of marine mammals in the member countries. This is on a random basis and also applies to Norwegian sealing. Reports from such observations are discussed in the NAMMCO Management Committee for Seals.

During the last 3-4 seasons various violations have been reported concerning the weapon regulations and in one case have resulted in a prosecution.

7. EDUCATION AND TRAINING OF INSPECTORS AND HUNTERS

Written information has been distributed to seal hunters from Governmental agencies since 1969, and the first training courses were held in the early 1980s. The current annual courses are mandatory, and are arranged by the Directorate of Fisheries. Since 1989 the hunters and inspectors are required to pass a written exam as condition for taking part in sealing.

During the courses the hunters are provided with a handbook of relevant laws and regulations, together with instructions on hunting procedures, weapons regulations, and regulations on the stunning, killing and bleeding of the seals. During the course, professional and technical personnel lecture on laws and regulations, and anatomy and physiology relevant to understanding the behaviour of seals, and the killing and bleeding of the seals. The hunters are also taught how to use the different tools correctly, the maintenance of the tools and how to

take care of the products from the hunt. Those taking part in the course must pass a written exam in order to receive an annual licence.

In addition, during the four-six days passage to the hunting grounds, the inspector together with the captain, shall arrange and overview mandatory training session on the use of hakapik for each hunter on the boat. In addition, the riflemen (2-4 on each vessel) must have passed an annual shooting test with the rifles and the ammunition which will be used during the season, before being issued with a licence to shoot seals.

8. ALTERNATIVES TO THE CURRENT STUNNING AND KILLING METHODS FOR SEALS

Questions have been raised as to whether the conventional methods used for the stunning of domestic animals in slaughterhouses could be used for the stunning/killing seals and in particular pups instead of using hakapik, which may be perceived as being unnecessarily brutal by some individuals. The most common methods used for domestic animals today are electricity, gas and captive bolts whilst firearms or pistols might also be used for farmed deer. The stunning and killing in slaughterhouses is carried out in two stages: the animal is stunned by one of the above-mentioned methods, and then bled out while still unconscious by having the carotid arteries or the arteries in the anterior thoracic cavity opened before consciousness, and thereby the perception of pain, can be regained.

The equipment and techniques used are specialized and their use requires the animal to be under physical control with the operator physically close to the animal.

However, neither the use of electricity, gas, nor captive bolts would be practical nor realistic to try in the environmental conditions in which the seal hunting is carried out. Nevertheless, the captive bolt has been suggested as an alternative several times, particularly by lay persons, but also by others. The reason is probably that this method has certain similarities to that of the hakapik. The only realistic alternative of today is firearms, although for practical and safety reasons only certain types of firearms and ammunition can be utilized.

CAPTIVE BOLT

The function of the captive bolt is to render the animal insensible, mainly by the impact of the bolt inducing brain concussion (*commotio cerebri*) (Daly et al 1987). The wound left by the bolt, which is usually restricted to the wound channel itself (Finnie 1993b), is of secondary importance. However, even in slaughterhouses there have been many variations in the stunning effects associated with the use of captive bolts on domestic animals (Mickwitz and Leach 1977, Gregory, Wotton and Lister 1983, Hyttel and Biering-Sørensen 1988; Blackmore and Delany 1988, Kestin 1992).

If captive bolts were to be tried on seals it would be essential for the result that the captive bolt pistol was held directly against the seal's head. However, the contact with the pistol would cause the seal (pup) to retract its head into the overlaying blubber/skin layer, which would cushion the impact and could result in the bolt missing the brain. However, the greatest problem would be of a technical nature, as this weapon would not function well under arctic conditions. The correct maintenance of the weapon is very important in order for it to function correctly, even indoors and if the bolt is not cleaned regularly, it will not retract completely. When used on seals on the ice, where temperatures can be far below the freezing point, debris from blood, blubber and brain

tissue would immediately build up on the bolt and prevent its retraction, probably already at the first stunning attempt, resulting in poor stunning results for the next animal. Even minor faults with the bolt will reduce its velocity by 40 % (Daly *et al.* 1987) and this will reduce the impact energy from the bolt by 60-70 %, which is a considerable reduction of its stunning capacity. Therefore, captive bolts, at least of their present design, which makes their function dubious enough indoors, should not be recommended for use outdoors in the arctic cold.

PISTOL AND REVOLVER

Pistols and revolvers have also been suggested as alternatives to the hakapik. They are seldom used to stun/kill animals, except for in emergency situations due to their inability to hit targets accurately from longer distances, and the danger of accidental shooting. Like captive bolts, the accurate use of these weapons requires that the weapon is held directly against the head when fired. In addition, in order to avoid dangerous ricochets, shooting on the ice requires special bullets that will not pass through the head. In Canada, Hughes (1983) conducted a series of experiments in the 1980s investigating the use of a modified .38-shot pistol as an alternative to the club for the killing of whitecoats. The experiments showed that this method was unsuccessful and it was never implemented in the hunt.

SHOTGUN

Modern firearms used for hunting can be divided into two groups: shotguns and rifles. The shotgun is designed for short-range hunting of relatively small game that moves quickly, while the rifle is designed for longer ranges and for hunting animals that are more or less standing still.

Shotguns, with correct ammunition, are very efficient for killing medium-sized and small terrestrial animals and may kill an animal of the size of a seal pup instantaneously. In order to achieve optimal effect the shot must be fired from some distance (10-30 m), and if several animals are gathered at the same ice floe, a shot may wound several other animals. Also the risk of ricochets (from steel shots against ice) and accidental hits (from slippery ground) means that using this hunting method could be dangerous endeavour for both animals and hunters. Another aspect is also that this method lessens the value of the skin considerably. The use of shotguns is therefore totally inappropriate to the Norwegian seal hunt situation.

CONCLUSIONS ON ALTERNATIVE HUNTING METHODS

The prescribed method for stunning and killing seals in the Norwegian hunt is unusual and differs considerably from the methods used for hunting other wild, free-living animals. During hunting of wild terrestrial animals, the stun/kill and bleeding out will, as a rule and normally, be carried out in one and the same operation, using weapons or projectiles which damage the central nervous system, the lungs and/or the circulation. In contrast, the prescribed method for killing domestic mammals is a two-step operation, with the stunning procedure being followed by bleeding out by opening the main vessels to the brain or from the heart. The current regulations prescribed for stunning and killing seals in the Norwegian hunt are more similar to the methods used for killing domestic animals in the slaughterhouses than for hunting wild, terrestrial mammals.

However, as the current methods used to stun domestic animals cannot be recommended for seals, it must be concluded that the only alternative to the hakapik is the modern rifle with adequate ammunition. This is a method widely used to kill millions of animals all over the world and would bring the seal hunt into line with other forms of modern hunting. Humans do not usually perceive this method as brutal. However, from an animal welfare point of view, the

question is whether this would be a real improvement and reduce the potential for the seals suffering or would it merely be a cosmetic change.

9. REGULATIONS

HUNTING OF ICE-BREEDING SEALS

Three central regulations, founded in the Salt-Water Fisheries Act, specifically regulate the hunt of ice-breeding seals in the Greenland Sea (the West Ice) and in the Barents Sea/White Sea area (the East Ice).

The Participation Regulation holds an inverse principle, i.e. there is a general ban against seal hunting, and an individual vessel can only obtain a licence to hunt if specified terms are met. Amongst others, these include that the vessel is suited and equipped for seal hunting and that the vessel's master has attended the Directorate of Fisheries course for seal hunters. The Participation Regulation is usually only valid for one year at a time (for one particular hunting season).

The Adjustment Regulation gives provisions on hunting areas, quotas, and hunting periods, and also gives provisions regarding reporting, control, and inspection. This regulation also holds the inverse principle, with a general ban against seal hunting and quotas only being allocated to licensed sealing vessels. The regulation includes a specific ban on the hunting of suckling pups (§4, 8) and gives date-defined definitions on when the pups are considered to be weaned (§10). The Adjustment Regulation is usually only valid for one year at a time (for one particular hunting season).

The Seal Hunting Conduct Regulation gives general and detailed provisions regarding the practice and methods of seal hunting of ice-breeding seals. The intentions and precautionary principle found in the Animal Welfare Act are implemented in the Regulation's main rule for the hunt (§1). The regulation gives detailed requirements for hunters (including courses, theoretical and practical tests) and requirements and technical specifications for weapons, ammunition, the hakapik, and the slagkrok. Provisions on specific hunting restrictions and banned hunting methods are given, and several detailed provisions on killing methods and hunting procedures are also included. A detailed description of the hunting practice and methods are given in Section 4 of this report.

HUNTING OF COASTAL SEALS

The coastal seal hunt is regulated by two central regulations and several local regulations. The local regulations are mainly related to restrictions on hunting in defined nature reserves and protected areas/zones. The two central regulations are founded in the Salt-Water Fisheries Act, while the local regulations are founded in the Nature Conservation Act.

The central *Management Regulation* aims to ensure viable seal populations, but within this scope the coastal seals may be harvested as a renewable resource and managed according to ecological and social considerations (§1). The regulation holds an inverse principle with a general ban on hunting seals and permission to hunt seals only after allocation of a special permit. The regulation gives provisions on hunting periods, requirements for hunters, reporting, and approved killing methods, including requirements and technical specifications for weapons and ammunition.

The central *Quotas regulation* gives quotas within defined hunting areas for harbour seals, grey seals, ringed seals, and harp seals. The Quotas regulation is usually only valid for one year at a time (for one particular hunting season).

HUNTING AT SVALBARD

Seal hunting at Svalbard is regulated by central and local regulations which are predominately founded in the Svalbard Environmental Protection Act. The local regulations are related to restrictions on hunting in defined national parks and nature reserves.

The purpose of the central Regulation on harvesting on Svalbard is to ensure that species natural productivity, diversity and habitat are protected, in order that the Svalbard wilderness is preserved for future generations. Within this frame, a limited and controlled harvest can take place (§1). The regulation only applies to marine mammals permanently inhabiting Svalbard. The regulation includes general provisions on humane harvesting, as well as special conditions related to hunting, including requirements for hunters, and more specific provisions and specifications on hunting practices and species-specific weapons and ammunition demands.

10. CONCLUSIONS OF THE *AD HOC* GROUP

RIFLE SHOOTING

The available scientific data show that the ammunition used in the hunt of pups is highly effective in causing instantaneous unconsciousness and death by means of destructive brain damage.

The current data from the Norwegian hunt of pups with rifle indicate high killing efficiency. Similar data are not available from the Norwegian hunt of 1+ animals. However, the fact that more powerful ammunition is used and the target area is larger in 1+ animals, it is likely that killing efficiency is comparable with that reported for pups. In order to conclude with more certainty further investigations are needed on the pathophysiological effects of the currently used ammunition and potential alternatives.

The most important requirements to achieve optimal results when using rifles for seal hunting are that the riflemen are well trained marksmen that know exactly where to hit the animal. Also the rifle and sightings must be well maintained, and the sightings must be checked or tested frequently or at regular pre-decided intervals.

HAKAPIK AS FIRST WEAPON

The scientific data on the efficiency of the Norwegian hakapik are limited. Nevertheless, based on data obtained in experiments, comparative studies and experience, it is the opinion of the *ad hoc* group that the hakapik is highly effective in causing instantaneous unconsciousness and death of seal pups. The fact that the hunter is close to the animal additionally contributes to a rapid kill.

The restricted availability of data requires that further studies are performed on the pathophysiological effect of the hakapik as currently used in the Norwegian hunt.

The most important requirements for optimal operation when using hakapik for the stunning/killing of pups are the same as for rifle hunt, namely that the operator is well trained and educated. The strike must hit the skull over the brain with sufficient force and the hakapik

must be equipped with a straight shaft, and with a sharp spike to limit the risk of skidding when it hits the harder bones of the skull of adult seals.

BLEEDING

Current bleeding practice results in rapid blood loss and is an effective method for exanguination in the field.

CURRENT PRACTICES

The three-step killing method required for 1+ seals (shooting, hakapik, bleeding) is a highly efficient and very conservative practice of stunning and killing a mammal. When correctly applied, it is the opinion of the *ad hoc* group that it is highly unlikely that the animal should remain conscious and alive when skinning starts.

This practice in the Norwegian seal hunt must be regarded much more conservative than the current practice in other wildlife hunts as well as in some methods used in the slaughter-house industry.

Current practice which requires training programs for sealers prior to the hunt contributes to correct performance. The *ad hoc* group encourages the continuation of this practice.

The *ad hoc* group does not regard current Norwegian seal hunt practice to violate any of the animal welfare principles as given in Norwegian and European animal welfare legislations.

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ADDENDUM I

LEGISLATION GOVERNING SEALHUNTING IN NORWAY

STATUES (ACTS)

An overview of the legislation that governs seal hunting in Norway is provided below. The complete text of the statutes and regulations can be found in Appendix I.

Norway's Animal Welfare Act applies to all animals, including wildlife. In the Act there are several general and specific provisions related to wildlife and hunting (terrestrial and marine). The general provision on how animals should be treated (§ 2) also applies to human contact and activities related to wild animals. The same is true for the general provision on aid (§6) which imposes an obligation to act on anyone who encounters injured, sick or helpless animals. The Animal Welfare Act's provision related to the killing of animals (§9) applies to wildlife and hunting, including that the killing of animals shall be carried out in such a manner that it does not cause unnecessary suffering, and that it is prohibited to skin animals before they are dead. The Norwegian Animal Welfare Act holds a precautionary principle with respect to suffering of animals, both in its general section (§ 2) and in the specific provision on killing (§ 9): it is not only forbidden to cause unnecessary suffering to animals, it is also forbidden to "*be in danger*" of causing unnecessary suffering to animals.

The Sea-Water Fisheries Act gives general provisions related to regulation, management, quotas, reporting, inspection and control during fisheries and during hunting of marine mammals. The Act on Sea-Water Fisheries also gives the legal authority for several of the specific regulations related to seal hunting (see section 2.2.1 and 2.2.2).

The Fishing and Hunting participation Act aims to regulate fisheries and hunting in order to ensure rational and sustainable use of the marine resources and sustainability for the coastal communities (§1). With respect to marine mammal hunting the most relevant sections are those that provide demands for licensing and special permits in order to hunt are the most relevant.

The Nature Conservation Act is in particularly relevant to the game hunting of coastal seals and seal hunting at Svalbard as the Act *inter alia* restricts hunting within protected areas and habitats (national parks and nature reserves).

The Svalbard Environmental Protection Act governs harvesting and hunting, including of marine mammals, at Svalbard and gives the legal authority of the hunting regulations at the Archipelago.

APPENDIX I

LEGISLATION GOVERNING SEAL HUNTING IN NORWAY

NOTE: The following collection of English translations of the Norwegian legislation related to seal hunting is **unofficial.** The translations have been compiled by using the databases provided by the Faculty of Law Library, University of Oslo (http://www.ub.uio.no/cgi-bin/ujur/ulov/sok.cgi?type=LOV), Lovdata (www.lovdata.no) and information provided from workshop reports of the North Atlantic Marine Mammal Commission (www.nammco.no). None of the listed institutions are responsible for any errors or flaws in the contents below. The official version of the regulations can be found at www.lovdata.no (in Norwegian only).

STATUES (ACTS)

Act of 20 December 1974 No. 73 relating to Animal Welfare (The Animal Welfare Act) (only provisions that are especially relevant to the seal hunt are included).

§ 1 Animals covered by the Act.

This Act applies to live mammals, birds, toads, frogs, salamanders (newts), reptiles, fish, and crustaceans.

§ 2 General provisions on how animals should be treated

Animals shall be treated well, and consideration shall be given to the instinctive behaviour and natural needs of animals, so that there is no danger of causing them unnecessary suffering.

§ 6 Aid

Should a person happen upon an animal which is obviously sick, injured, or helpless, he must help it as far as possible. Should it prove impossible to give assistance or sufficient help, and the animal in question is a domestic animal, tame reindeer, or large game animal, he shall, as soon as possible, inform the owner or the person in charge of the animal, or the nearest police authority.

When it is obvious that the animal cannot survive or make a complete recovery, the person happening upon the animal can kill it in accordance with the provisions of § 10, if this is necessary to spare it from further suffering. A person, who kills a domestic animal, tame reindeer, or large game animal, must notify the nearest police authority as soon as possible. Domestic animals, tame reindeer, and large game animals, must not be killed in accordance with these provisions if it is possible to get hold of the owner or person in charge, a veterinarian, or the police, within a reasonable period of time.

Expenses incurred in carrying out measures in accordance with the provisions of this Section shall be reimbursed from public funds, but may be recovered from the owner or person in charge.

…§ 8 Certain ways in which it is prohibited to treat animals

It is forbidden:

1. To kick animals, or hit them with sticks, with ropes or knotted thongs or the like, or to hit them with anything else which may cause as much pain.

…§ 9 Killing of animals.

The killing of animals shall be carried out in such a manner that there is no danger of causing unnecessary suffering.

In connection with the killing of horses, cattle, sheep and goats, pigs, poultry, rabbits, or domestic reindeer, the animal shall be stunned before being bled. The killing of such animals must only be performed by persons over the age of 16, and who have the necessary skills. As far as possible, killing shall be performed out of sight of other animals.

Animals must not be skinned, scalded, or plucked, before they are dead. This does not, however, apply to crustacean.

The provisions of the first and third sub-sections do also apply for hunting and catching.

§ 10 Emergency killing.

When an animal has to be killed immediately because it is ill, injured, or helpless for other reasons, this must be carried out so that the animal suffers as little as possible, and in best possible accordance with the provisions laid down in § 9. The weapon used shall be sufficiently effective so that the animal is not exposed to the risk of unnecessary suffering.

The provisions of the first paragraph above also apply to the killing of domestic animals which have become so wild that they are not able to be caught in the normal way.

Act of 3 June 1983 NO. 40 relating to sea-water fisheries, etc. (The Sea-water Fisheries Act) (only provisions that are especially relevant to the seal hunt are included).

§ 1 Territorial scope of the Act

In respect of Norwegian nationals and persons resident in Norway, this Act shall be applicable:

a) in waters under Norwegian jurisdiction,

b) in waters outside any national fisheries jurisdiction if fishing or hunting is being conducted using a Norwegian vessel,

c) in waters under the fisheries jurisdiction of a foreign state if fishing or hunting is being conducted using a Norwegian vessel, but only as regards Chapters II, III, X and section 24. The King may decide that other parts of the Act shall also apply to Norwegian vessels in such waters.

Pursuant to this Act, the following persons are considered to be on an equal footing with Norwegian nationals or persons resident in Norway:

a) limited liability companies and other companies with limited liability, if the head office and the seat of the Board are in Norway,

b) the state, facilities and funds administered by the state, and Norwegian municipalities,

c) any person engaged in fishing or hunting with a Norwegian vessel.

The term Norwegian vessel connotes a vessel which satisfies the conditions set out in section 1 of the Maritime Act.

§ 2 Substantive scope of the Act

This Act applies to marine fisheries with the exception of fishing for anadromous salmonids. For the purposes of this Act, the term fish also includes crustaceans and molluscs.

Chapters II, III, IV, IX and X and section 24 of the Act also apply to sealing and whaling. The King may decide that other chapters of the Act shall apply in whole or in part to such activities. The King may also decide that Chapters V and X shall apply to fishing for anadromous salmonids.

The King may also decide that Chapters II, V, VI, VIII and X shall apply in whole or in part to activities other than fishing.

The Directorate of Fisheries may permit scientific investigations and practical fishery experiments to be conducted notwithstanding the provisions set out in this Act or issued pursuant thereto.

§ 4 Authority to regulate fisheries

In order to ensure the proper management of the living resources in the sea, if international agreements so require, or if it is necessary for conducting or completing fishing or hunting activities in a rational or proper manner, the Ministry may lay down regulations concerning:

a) total allowable catches, including catches allocated by regions and gear,

b) close seasons and prohibitions on fishing and hunting in specific areas or for specific species,

c) minimum sizes and weights,

…

f) prohibitions or restrictions on catching methods and uses of gear,

…

j) the time of leaving harbour to participate in fishing or hunting,

k) prohibitions on particular uses of catches,

l) fishing, hunting and seaweed harvesting conducted in the same area,

m) prohibitions against carrying particular types of gear on board and against the stowing of fishing gear which may not be used in the area where the vessel is present,

n) harvesting of flora and fauna which is destructive of species that should be protected,

o) harvesting of flora and fauna which provide food for species that should be protected,

…

s) requirements to carry and use specific equipment for catch inspection, reporting and determination of position. The Ministry may determine the degree to which the vessel shall meet the costs of purchasing, installing and using such equipment.

The Ministry may prescribe that part of the total quota for an individual stock as determined pursuant to section 4 shall be delivered for processing at shore facilities in particular districts. Specific quantities of the total quota may be reserved for specific periods of time and specific classes of vessels.

§ 5 Vessel quotas

If the total allowable catch has been fixed for a particular stock pursuant to section 4, or if so required in the interests of economic and rational exploitation of a particular stock, the Ministry may lay down regulations governing quotas for the vessels participating in the fishery for specific periods and per trip.

Limits on catches may be made applicable to one or more gear classes, vessel classes or size classes.

Quotas for vessels may be set on the basis of their size, loading capacity, and crew when processing the catch on board or ashore. Different quotas may also be set for different gear classes.

Quotas for vessels engaged in fishing or hunting using the same gear may for one season be determined on the basis of an overall quota for several fisheries which are subject to quota regulations. Provisions restricting catches or excluding vessels from certain fisheries which are subject to quota regulations may also be laid down if the vessels are granted a reasonable overall fishing arrangement in other fisheries.

…

§ 9 Duty to report catch data and keep a radio watch

The Ministry may by regulations order the owner or user of a fishing or hunting vessel to submit reports to the fisheries administration and sales organizations concerning catch sizes, fish species, catch periods, catch areas, fishing gear, catch values, the time of departure from fishing grounds, the time of arrival at port, to whom and for what purpose the catch is to be delivered and accounts for the operation of the vessel. The Ministry may lay down further regulations concerning the duty to submit reports and provide information, including separate provisions on processing on board, prior notification, delivery of catches and when and how often reports are to be submitted.

The Ministry may by regulations prescribe that participants in hunting or fishing operations shall keep a watch on particular radio frequencies at given times to receive notification of any regulatory measures that are being implemented. The Ministry may issue further rules on the announcement of such reports. The Ministry may also by regulations prescribe that owners or operators of fishing vessels shall keep a radio watch and answer calls etc. on the radiotelephone.

§ 9a Duty to submit reports on receipt of catches

The Ministry may by regulations prescribe that any person who receives or sells catches from a Norwegian or foreign vessel shall submit reports and provide information, including prior notification of intention to call at a port, to the fisheries administration and the sales organizations.

…

§ 45 Authority of the Directorate of Fisheries

The Directorate of Fisheries shall ensure compliance with the provisions of this Act and of sections 3 and 4 and litra b of section 7 of the Act of 17 December 1976 No. 91 relating to the Economic Zone of Norway, and regulations issued pursuant to thereto.

When exercising its control duties, the Directorate of Fisheries shall be given unimpeded access to vessels, processing facilities, storehouses and harbour areas. The person in command of a vessel or such facilities shall give the Directorate of Fisheries any necessary assistance and information, produce relevant objects and documents etc., certify copies and allow comments on contravention to be entered in the catch logbook, sales note and the like. Vessels may be stopped for inspection. The Directorate of Fisheries may if necessary request the assistance of the police in carrying out the inspection.

Inspectors may be placed on board to carry out inspection duties and observers may be placed on board to observe and register fishing operations. Necessary board and lodging shall be provided at the vessel's expense. The inspector or observer shall have use of the radio and other communication equipment without charge.

The Directorate of Fisheries may inspect ship-owners' accounts and order deep-freezing enterprises to provide information about catches which are temporarily stored on their premises. The owner and the person in charge on board a vessel which supplies fish to foreign countries or to foreign ships, and businesses or companies which supply fish or fish products abroad may be ordered to provide the necessary information for the purposes of control according to the first paragraph.

The Directorate of Fisheries may establish a register for the collection, storage and use of information obtained using equipment such as is mentioned in section 4, first paragraph, litra s. The Ministry may by regulations lay down further provisions relating to the registration and use of information in the register.

The Ministry may lay down regulations concerning the control exercised according to this section, including provisions laying down:

a. the authority and duties of the observer,
b. which vessel classes and how many vessels shall carry an inspector or observer on board, and how the vessels are to be selected,
c. that the vessel shall wholly or partly meet the wage and transport costs, etc., incurred in implementing the inspection and observation schemes,
d. that the costs of the inspection and observation schemes shall be divided among all participating vessels in a specified vessel class, and
e. that vessels that have not paid the costs imposed in connection with the inspection and observation schemes may be refused permission to take part in fishing operations.

…

Act of 26 March 1999 No. 15 relating to the right to participate in fishing and hunting (The Fishing and Hunting participation Act) (only provisions that are especially relevant to the seal hunt are included).

§ 1 Aim of the Act

The aim of this Act is:

a. to adjust the fishery fleet's catching capacity to the resources to ensure a rational and sustainable use of the marine resources

b. to increase the profitability and added value of the industry to secure the sustainability of the settlements and workplaces in the coastal districts

c. to arrange for that the harvesting of the marine resources benefits the coastal population

…

§4 Demand for occupational licence

A vessel can not be used for occupational fishing or hunting without a special occupational licence issued by the Ministry.

…

§ 12 Demand for special permit for certain types of fisheries and for hunting

It is not allowed without a special permit from the Ministry to:

…

e. hunt seals

Act of 19 June 1970 No. 63 relating to nature conservation (The Nature Conservation Act) (only provisions that are especially relevant to the seal hunt are included).

Chapter I. Objectives and general provisions

§ 1

The natural environment is a national asset that must be protected.

Nature conservation means the management of natural resources on the basis of the close interdependence between mankind and nature, and the need to maintain the qualities of the natural environment for posterity.

Everyone must show consideration and care in his contact with the natural environment.

Any intervention in the natural environment should only take place on the basis of long-term, all-round management of natural resources, which takes into account the preservation of the natural environment for the future as the basis of human activity, health and well-being.

…

Chapter II. Conservation of particular areas of natural habitat and natural features

National parks

§ 3

In order to preserve larger areas of state owned undisturbed or largely undisturbed or distinctive or beautiful areas of natural habitat may be designated as national parks.

…

§ 4

The decision to designate an area as national park will be taken by the King, who will issue further provisions concerning the area and its management, including the protection of the flora and fauna.

…

Nature reserves

§ 8

Areas where the natural environment is undisturbed, or largely undisturbed or of a special nature type, and which are of particular scientific or educational significance or which stand out because of their distinctive character, may be protected as nature reserves. An area may be totally protected or protected for specific purposes as forest reserve, mire reserve, bird reserve or the like.

§ 9

In areas of particular importance for plants or animals which are pursuant to § 13 or 14, development, construction, pollution and other disturbance may be prohibited to preserve their habitat.

The same applies to plant or animal habitats which are or will be protected pursuant to other legislation.

§ 10

Decisions pursuant to §§ 8 and 9 will by made by the King, who may lay down further provisions concerning such areas and their management.

…

Chapter III Special provisions on protection of plants and animals

§ 14

The King may prescribe that animal species or animal communities which are rare or in danger of disappearing shall be protected and preserved throughout the country or in particular areas.

In an area of particular importance as habitat for a number of species, mammals and birds may be protected and preserved.

…

Protection may be limited in time.

Act of 15 June 2001 No. 79 relating to the protection of the environment in Svalbard (The Svalbard Environmental Protection Act) (only provisions that are especially relevant to the seal hunt are included).

§ 1 Purpose of the Act

The purpose of this Act is to preserve a virtually untouched environment in Svalbard with respect to continuous areas of wilderness, landscape elements, flora, fauna and cultural heritage.

Within this framework, the Act allows for environmentally sound settlement, research and commercial activities.

…

§ 25 The principle of general protection

All species of flora and fauna, including their eggs, nests and lairs, are protected unless otherwise provided by this Act.

…

§30 What protection of the fauna involves

No person may hunt, capture, injure or kill fauna or damage eggs, nests or lairs unless so authorized by the provisions of this chapter.

…

No person may subject fauna to anaesthetic or immobilizing agents without the permission of the Governor.

The use of poison or chemicals for the purpose of killing is prohibited. The Governor may in special cases grant exemptions from this prohibition.

…

§ 31 General provisions relating to harvesting

Harvesting and collection of eggs and down is only permitted for those species prescribed by the Ministry in regulations.

Harvesting of a particular species is only permitted in the time period and to the extent prescribed by the directorate in regulations. The period when harvesting is permitted shall not be during the breeding or nesting season of a species. The Governor may nevertheless grant permission for egg and down collection.

Harvesting shall be carried out without inflicting unnecessary suffering on game species and without putting human life in danger or causing any risk of damage to property. The directorate will issue regulations relating to hunting, trapping and fresh-water fishing, including harvesting methods and equipment.

When decisions are made pursuant to this section, due consideration shall be given to ensuring that harvesting does not significantly alter the composition and development of the stocks in question.

§ 32 The right to harvest fauna

Any person has the right to harvest fauna and to collect eggs and down in accordance with the provisions laid down in and pursuant to section 31, unless otherwise determined by this section or section 26 of the Act relating to Svalbard.

Harvesting may only be carried out by a person who holds a licence (hunting licence, fishing licence). No person may be issued with a hunting licence before reaching the age of 16 years. The ministry may issue further regulations regarding licences and fees payable for licences and for each animal killed, regarding training and tests as conditions for being issued with a hunting licence, regarding the right to participate in hunting and trapping for training purposes and regarding other conditions for harvesting.

The ministry may for particular species issue regulations to the effect that they may only be harvested by permanent residents or with the permission of the Governor. Within the framework of regulations laid down pursuant to sections 31 and 32, the Governor may further regulate harvesting locally by regulations. A permit may state conditions, including the areas or time period to which the permit applies, the quantity that may be harvested and the types of harvesting methods or gear that may be employed.

The Governor may grant wildlife trappers who over winter in trappers' cabins the exclusive right to harvest within a defined area and time period. Before such exclusive rights are granted, the Governor shall publicly announce that applications for the grant of exclusive rights may be made within a given time limit. Decisions granting exclusive rights shall indicate the species that are covered by such rights. Conditions may be attached to such rights, including conditions relating to inspection and control tasks, cf. Chapter VIII, and to training. The Governor may prescribe regulations regarding the allocation of trapping areas with exclusive harvesting rights.

REGULATIONS

Regulations relating to the hunting of seals in the west ice and east ice in 2006 (The Participation Regulation)

Laid down by the Ministry of Fisheries and Coastal Affairs on 20 February 2006 pursuant to sections 4, 5 and 45 of the Act of 3 June 1983 No. 40 relating to Sea-water Fisheries and section 12 of the Act of 26 March 1999 No. 15 relating to the right to participate in fishing and hunting, cf. the decision of 11 February 2000 No. 99 on delegation of authority. Amended by the Regulations of 13 March 2006 No. 303.

Chapter I: Participation in the seal hunt

§ 1 Prohibition

It is prohibited for Norwegian vessels to take part in sealing in 2006.

§ 2 Exemptions from the prohibition on sealing and conditions for participation

Notwithstanding the prohibition of section 1, Norwegian vessels may take part in sealing provided that the following conditions are met:

a) The vessel must be registered in the register of fishing vessels.
b) The vessel must be suitable for and equipped for seal hunting.
c) The master of the vessel must have attended the course held by the Directorate of Fisheries for seal hunters in 2006. The same applies to members of the crew who did not attend the said course in 2005.

The Directorate of Fisheries may in special cases grant exemptions from the provisions of litra c) above.

Chapter II: The West Ice

§ 3 Sealing area

The West Ice is defined as the pack ice areas in the fisheries zone around Jan Mayen and the sea areas around Jan Mayen outside the fishery zone of Greenland and southwest of Svalbard.

§ 4 Total allowable catches (TACs)

Vessels that meet the conditions laid down in section 2 may catch up to 31 200 adult harp seals and 4 000 adult hooded seals in the West Ice.

The TACs may also be taken as weaned pups. If weaned harp seal pups are taken, two pups shall be equivalent to one adult. If weaned hooded seal pups are taken, one pup shall be equivalent to one adult.

§ 5 Prohibition on hunting

It is prohibited to catch unweaned pups of harp and hooded seals.

It is prohibited to hunt adult female seals in whelping areas.

§ 6 Hunting season

It is prohibited to hunt for hooded seals before 20 March at 0700 UTC and for harp seals before 10 April at 0700 UTC.

Hunting for hooded seals shall be discontinued on 10 July at 2400 UTC, and hunting for harp seals shall be discontinued on 30 June at 2400 UTC. If weather and ice conditions so indicate, the hunting season may be extended.

§ 7 Departure

Vessels that have been granted licences to take part in sealing in the West Ice must sail for the sealing area by 10 April.

Chapter III: The East Ice

§ 8 Hunting area

The East Ice is defined as the areas east of 20°E in the Russian Economic Zone.

§ 9 Quota

Vessels that meet the conditions laid down in section 2 may catch up to 10 000 adult harp seals in the East Ice.

The quota may also be taken as weaned pups. If weaned harp seal pups are taken, 2.5 pups shall be equivalent to one adult.

§ 10 Prohibition on hunting

It is prohibited to catch unweaned pups of harp seals.

It is prohibited to hunt seal species other than harp seals.

§ 11 Hunting season

It is prohibited to hunt for hooded seals before 23 March at 0700 UTC.

The hunt shall be discontinued on 15 May at 2400 UTC.

Chapter IV: General provisions

§ 12 Definitions

A pup is defined as a seal that is less than one year old. Older animals are considered to be adults.

A hooded seal pup is considered to be unweaned before 20 March.

A harp seal pup is considered to be unweaned before 20 March in the East Ice and 10 April in the West Ice.

§ 13 Registration

Any person who wishes to take part in the seal hunt must send registration in writing to the Directorate of Fisheries before 15 February.

§ 14 Distribution of vessel quotas

The Directorate of Fisheries may distribute the TACs for harp seals in the West Ice and the East Ice to the vessels that are to take part. Vessels that take part in the hunt in the East Ice may be allocated reduced quotas in the West Ice.

§ 15 Reallocation of quotas

The Directorate of Fisheries may revoke or change the quotas that have been laid down.

To ensure that the entire TAC is taken, the Directorate of Fisheries may reallocate the quotas as appropriate. The Directorate may lay down a date for reallocation of quotas.

The Directorate of Fisheries may set a time limit for the start of hunting operations after the reallocation of quotas. Vessels that do not observe the time limit will lose their right to take part.

§ 16 Keeping catch logbooks

Vessels participating in the seal hunt shall keep a catch logbook. The catch logbook shall be sent to Directorate of Fisheries as soon as possible after the end of a hunting trip.

§ 17 Control

The Directorate of Fisheries may decide that sealing vessels shall carry an inspector on board during the hunt. Vessels may also be required to carry observers on board during the hunt.

§ 18 Authority

The Directorate of Fisheries may amend these regulations and lay down any further provisions necessary for conducting or completing the seal hunt in a rational or proper manner.

§ 19 Penal measures

Any person who wilfully or negligently contravenes provisions set out in or issued pursuant to these regulations is liable to a penalty pursuant to section 53 of the Act of 3 June 1983 No. 40 relating to Sea-water Fisheries and section 29 of the Act of 26 March 1999 No. 15 relating to the right to participate in fishing and hunting. Complicity or an attempt to contravene the said provisions is subject to the same penalty.

§ 20 Entry into force

These regulations enter into force immediately and apply until 31 December 2006 inclusive.

Regulation on the adjustment of the seal hunting in the West Ice and East Ice in 2007 (The adjustment regulation) (FOR 2007-02-23-201)

Chapter I

§ 1 General ban

It is forbidden for Norwegian vessels to hunt seals in 2007.

Chapter II West Ice

§ 2 Hunting area

The West Ice is the drift ice areas in the fishery zone at Jan Mayen and in the waters around Jan Mayen outside the Greenlandic fishery zone and southeast of Svalbard.

§ 3 Quotas

Regardless of the ban in § 1 Norwegian vessels that are licensed to sealing may hunt up to 31,200 adult harp seals in the West Ice.

The quotas may be taken as non-suckling pups. One adult animal corresponds to two non-suckling pups.

§ 4 Hunting ban

It is forbidden to hunt suckling harp seal pups.

It is forbidden to hunt females in the breeding areas.

§ 5 Hunting period

It is forbidden to hunt harp seals before 10 April at 07 00 UTC.

Hunting of harp seals has to end 20 June at 24 00 UTC. The hunting period may be extended due to weather and ice conditions.

Chapter III. East Ice

§ 6 Hunting area

The East Ice is the areas east of 20 ° E in the Russian economic zone.

§ 7 Quotas

Regardless of the ban in § 1 Norwegian vessels that are licensed for sealing may hunt up to 15,000 adult harp seals in the East Ice.

The quotas may be taken as non-suckling pups. One adult animal corresponds to 2,5 non-suckling pups.

§ 8 Hunting ban

It is forbidden to hunt suckling harp seal pups.

It is forbidden to hunt other seal species than harp seals.

§ 9 Hunting period

It is forbidden to hunt harp seals before 23 March at 07 00 UTC.

The hunting has to end 15 May at 24 00 UTC.

Chapter IV. General provisions

§ 10 Definitions

A pup is to be regarded as an animal younger than one year old. Older animals are to be regarded as adults.

The harp seal pups are to be regarded suckling before 20 March in the East Ice and before 10 April in the West Ice.

§ 11 Distribution of quotas

The Directorate of Fisheries may distribute the quotas of harp seals in the West Ice and East Ice to the participating vessels. Vessels that participate in the hunt in the East Ice can be given a reduced quota in the West Ice.

§ 12 Redistribution

The Directorate of Fisheries can withdraw or change the given quotas.

The Directorate of Fisheries may redistribute the quotas in the most expedient way in order to ensure the total quotas. The Directorate of Fisheries may determine the date for such redistribution.

The Directorate of Fisheries may determine a deadline for the start date for the hunt on the redistributed quota. Vessels that do not comply with this deadline will loose their hunting permission.

§ 13 Hunting logbook

Vessels that are participating in the seal hunt have to register their activity in the hunting logbook. The logbook has to be send to the Directorate of Fisheries as soon as the hunting trip has ended.

§ 14 Control

The Directorate of Fisheries have the power to decide that the vessels have to have an inspector on board during the hunt.

The vessels may also be instructed to have an observer on board during the hunt.

§ 15 Authorization

The Directorate of Fisheries may change this regulation and determine more detailed regulations if necessary.

§ 16 Criminal liability

Anyone that intentionally or involuntarily violates the provisions in this regulation will be punished according to the Law of 3 June 1983 nr. 40.

§ 16 Entry into force

This regulation comes into force immediately and is valid until 31 December 2007.

Regulations relating to the conduct of the seal hunt in the west ice and east ice

Laid down by the Ministry of Fisheries on 11 February 2003 pursuant to section 4, litra f, and section 24, second paragraph, of Act of 3 June 1983 No. 40 relating to Sea-water Fisheries.

§ 1 General principle of the seal hunt

During the seal hunt, the hunters must show the greatest possible consideration and use hunting methods that prevent animals from suffering unnecessarily. Injured animals shall be killed as soon as possible.

§ 2 Definitions

1. A "pup" is a seal that is younger than one year old. Older animals are considered to be adults.

2. Hunting of individual seals means hunting single animals from the ship while it is moving forward in the ice.

§3 Requirements relating to hunters

Any person who intends to participate in the seal hunt must have attended a course and have passed the tests prescribed by the Directorate of Fisheries.

Only marksmen who have passed a separate shooting proficiency test may shoot seals during the hunt. A new test must be taken prior to every seal hunting season. The test shall be taken with the same weapon and the same type of ammunition as will be used during the hunt.

Any person who intends to participate in the seal hunting shall have passed a separate test on the use of the "hakapik".

The Directorate of Fisheries may lay down further provisions on the implementation of the rules set out above.

§ 4 Requirements relating to weapons and ammunition

For shooting adult seals, a firearm with a rifled barrel shall be used together with ammunition with expanding projectiles and an impact energy of at least 2 700 joules (275 kg/m) for 9 gram bullets and 2 200 joules (225 kg/m) for 10 gram bullets at a range of 100 metres.

For shooting seal pups, a rifle shall be used together with ammunition with expanding projectiles and an impact energy of at least 981 joules (100 kg/m) at a range of 100 metres.

A rifle and ammunition approved for adult seals shall at all times be available at the marksman's position on board during seal hunting.

Rifles must be inspected and approved by a gunsmith before departure and sighted in with the ammunition that is to be used during the hunt.

§ 5 Requirements relating to hakapiks and seal clubs (slagkrok)

1. A hakapik shall have a straight wooden shaft made of birch and between 110 and 150 cm in length, with a diameter of between 3 and 5 cm. The hakapik shall be fitted with a metal ferrule that weighs at least 400 g and that has a slightly bent spike between 12 and 18 cm in length. Opposite the spike, the ferrule may have a blunt projection that shall not be more than 4 cm long. The metal ferrule shall be firmly attached to the shaft. The tip of the hakapik shall be kept sharp at all times.

2. A seal club shall be 50 cm long, half an inch thick and weigh at least 1 000 grams, at least 250 g of which shall be accounted for by an additional weight welded next to the hooked end.

3. The design of hakapiks and seal clubs (slagkrok) and the materials used shall be in accordance with the Seal Hunt Committee's decision of 4 November 1970 and the drawings of the same date.

§ 6 Prohibitions on hunting

1. It is prohibited to hunt:

a) seal species other than harp and hooded seals

b) adult female hooded seals and adult harp seals in whelping areas

c) seals that are in the water.

2. It is prohibited to shoot seals if conditions are such that they cannot be struck with a hakapik or seal club afterwards and be bled on the ice. Exceptions apply during the hunting of seal pups if the conditions of section 10 are met, and during the hunting of individual seals if the conditions of section 7, fifth paragraph, are met.

§ 7 Killing methods

Animals shall be killed in such a way that they do not suffer unnecessarily.

Adult animals shall be shot. Pups shall be shot or struck with a hakapik or seal club.

An animal that has been shot shall be struck with a hakapik as soon as possible. A pup may also be struck with a seal club.

When a hakapik or seal club is used, the seal shall be struck on the skull. It shall first be struck with the butt end or blunt projection of the tool, so that the skull is crushed. After that, the animal shall be struck with the spike of the tool, so that it penetrates deep into the brain. If an animal has been shot and is lying still, it is sufficient to use the spike of the tool only.

Seals shall be bled on the ice immediately after they have been struck with a hakapik or seal club. During hunting of individual seals, seals may be bled on board if they are taken on board immediately and conditions otherwise so indicate.

Seals shall be bled by making a cut from the underside of the jaw to the end of the breastbone, then cutting the blood vessels to the fore flippers.

§ 8 Special provisions relating to shooting seals from the ice or from a catcher boat

When seals are shot from the ice or from a catcher boat, all the animals shall be struck with a hakapik and bled as soon as the ongoing hunt makes this possible.

During this type of hunting, at least one person shall at all times be assigned to each marksman to club and bleed animals that are shot.

§ 9 Fastening lines to seals

It is prohibited to fasten a line to an animal on the ice before it has been struck with a hakapik or seal club and bled. Exceptions apply during hunting of individual seals from the ship while it is moving forward in the ice for animals that are obviously dead.

§ 10 Hooking of seals

It is prohibited to use a hook to lift seals that have not been bled on board the vessel.

Pups that have been shot may be lifted on board using a hook if there is no doubt that they are dead and the ice conditions make it unadvisable to walk on the ice.

§ 11 Prohibited hunting methods

It is prohibited to:

a) hunt or kill seals using lines, nets or any form of trap

b) use a firearm with an unrifled barrel

c) use a hakapik on adult animals that have not been shot

d) use a seal club on adult animals

e) strike animals with a hakapik or the club anywhere but on the skull

f) kill seals in artificial light.

§ 12 Use of aeroplanes

It is forbidden to use an aeroplane or helicopter for hunting purposes. An aeroplane or helicopter may be used from land to reconnoitre the hunting areas.

§ 13 Exemptions from the hunting provisions in emergencies

It is permitted to depart from the hunting provisions to the extent necessary

a) to kill animals that are injured

b) out of consideration for the safety of the hunters and vessels.

§ 14 Responsibilities

The master of a vessel shall ensure that the sealers comply with the hunting provisions.

When hunting takes place on the ice or from a catcher boat, the leader of the hunting team is also responsible for compliance with the hunting provisions.

In addition, the individual hunter is responsible for compliance with the hunting provisions.

§ 15 Penal measures

Any wilful or negligent contravention of these provisions is subject to a penalty pursuant to section 53 of the Act of 3 June 1983 No. 40 relating to Sea-water Fisheries.

§ 16 Entry into force

These regulations enter into force immediately.

From the same date, the Regulations of 20 February 1991 No. 117 relating to seal hunting in the West Ice and the East Ice are repealed.

Regulation on the ban to do seal hunt without permission (FOR 1969-03-21-01)

I

It is forbidden to hunt seal (of all species) without the permission from the King or those that He authorizes. The permission may be limited to specific hunting areas.

II

This resolution is in force from 1 July 1969.

Regulation on seal hunting (FOR 1969-06-27-05)

I

The provisions under I in the King's resolution of 21 March 1969 on seal hunting do not apply for the coastal seal hunt.

II

Hunting of seals in connection with tourist cruises can only take place with a special licence from the Ministry of Fisheries.

III

This resolution is in force from 1 July 1969.

Coastal seal hunting

Regulations for the management of seals on the Norwegian coast (The Management Regulation) (FOR-1996-05-06-414)

§ 1 Aim

The aim of the management of seals on the Norwegian coast is to ensure vigorous seal populations. Within this scope, the seals may be harvested as a renewable resource, and the populations regulated according to ecological and social considerations.

§ 2 Geographical implementation area

The regulation is valid within the Norwegian fishery limit outside the Norwegian mainland.

§ 3 Action area

The regulation applies to the hunt of seals of all species.

§ 4 Hunting ban

It is forbidden to hunt, catch, chase, kill or harm seals.

§ 5 Permission to hunt seals after allocation of a special licence

Regardless of the ban in § 4 the Directorate of Fisheries or those who the Directorate authorize may after receiving an application, issue a seal hunting licence within a total quota in areas where the populations are regarded large enough for hunting. The licence may only be issued to a specific person and within a defined area. The licence can not be given during the breeding period. Besides the § 32 first and second part in Law of 29 May 1981 nr. 38 applies.

Hunting licence for grey seals in the areas south of Stad may only be given within the period 1 February – 30 September.

Hunting licence for harbour seals may only be given within the period 2 January – 30 April and 1 August and 30 September.

Hunting licence for grey seals in the areas north of Stad may only be given within the period 2 January – 15 September.

Hunting license for ringed seal and harp seals along the whole coast may only be given within the period 2 January – 30 September.

The hunter must have passed the shooting test for big game hunters before a hunting licence may be issued.

The Directorate of Fisheries or those who the Directorate authorizes can stipulate maximum quotas per hunter within defined areas.

An applicant that have violated the rules for hunting seals, including the reporting provisions in § 12, can be refused a permit.

§ 6 Closing date

In order to participate in the hunt for seals according to § 5 a written application hast to be send to the Directorate of Fisheries Regional office in the hunting area of concern

§ 7 Obligation to report the killing of seals and to inquire if any seals are left on the quota

Killing of seals must be reported to the Directorate of Fisheries Regional office in the area of concern as soon as possible, within normal opening hours. The Director of the Regional office may instruct, when seen necessary, the hunters an obligation to submit a report within a given time period during the weekends.

Before the hunt starts, the hunters are obliged to inquire, at the Directorate of Fisheries Regional office in the area of concern, whether there are any seals left of the total quota for the area in question.

§ 8 Stop in the hunt

The Directorate of Fisheries or those who the Directorate authorize may stop the hunt in the county or when the total quota is estimated caught.

§ 9 Exceptions from the hunting ban

Seals that damage fishing gears or fish farms in the sea can be killed. The killing may be performed by the owner, user or another person who has supervision responsibility with the gear or farm.

Seals that reside in watercourses where salmon, sea trout, or Artic char can be killed following permission issued by the Directorate of Fisheries Regional office.

Before seals are killed reasonable other measures should be attempted to avoid damage on gears or farms. If females are killed during the breeding period, the pup should also if possible be killed.

The Directorate of Fisheries or those who the Directorate authorize, may in particular cases give permission to catch seals.

§ 10 Killing method

When seals are killed the hunters must show the uttermost care and employ human killing methods that prevent unnecessary suffering to the animals.

For the killing of seals the following apply:

1. Only rifles shooting ammunition with expanding bullets and impact energy of at least 2,700 joules (275 kilogram-meters) for 9 gram bullets and 2,200 joules (225 kilogram-meters) for 10 gram bullets at a distance of 100 meters shall be used.
2. It is prohibited to catch or kill seals using lines, fishing nets, scissors, fish traps or any other form of traps. It is prohibited to use firearms with a smooth unrifled barrel or use a hakapik or any other form of striking hook for killing.

§ 11 Obligation to report

Every licensed seal hunter must report on a special form to the Directorate of Fisheries or those who the Directorate authorize. This applies even when no seals have been hunted.

Killing of seals has to be immediately reported to the Directorate of Fisheries or those who the Directorate authorize pursuant to the provisions of § 9.

§ 12 Criminal liability

Intentional or involuntary violation of the provisions in this regulation will be punished according to § 53 in the Law of 3 June 1983 nr. 40.

§ 13 Entry into force

This regulation comes into force immediately. At the same time the Regulation of 29 November 1984 nr. 1951 is annulled.

Regulation on quotas in the coastal seal hunt in 2007 (The quotas regulation) (FOR-2006-11-20-1289)

§ 1 Harbour seal

Individuals that have been granted permit to hunt coastal seals in accordance with the Regulation of 6 May 1996 nr 414 §5 may hunt within the following total quotas of harbour seals:

County	***Quota***
Østfold	30
Rogaland	47
Sogn og Fjordane	42
Møre og Romsdal	62
Sør-Trøndelag	199
Nord-Trøndelag	18
Nordland	321
Troms	95
Finnmark	46

It is not allowed to hunt harbour seals in Lysefjorden in Rogaland.

It is not allowed to hunt harbour seals in Indre Sognefjorden.

§ 2 Grey seal

Individuals that have been granted permit to hunt coastal seals in accordance with the Regulation of 6 May 1996 nr 414 §5 may hunt within the following total quotas of grey seals:

Area	***Quota***
Lista to Stad	60
Stad to Lofoten	905
Vesterålen to Varanger	221

§ 3 Ringed seal

Individuals that have been granted permit to hunt coastal seals in accordance with the Regulation of 6 May 1996 nr 414 §5 may freely hunt ringed seals in Nordland, Troms and Finmmark.

§ 4 Harp seal

Individuals that have been granted permit to hunt coastal seals in accordance with the Regulation of 6 May 1996 nr 414 §5 may freely hunt harp seals along the Norwegian coast.

§ 5 Criminal liability

Intentional or involuntary violation of the provisions in this regulation will be punished according to the Law of 3 June 1983 nr. 40. Contribution to or attempts to violate this regulation will be punished likewise.

§ 6 Entry into force

This regulation comes into force immediately and is valid until 31 December 2007.

Seal hunt on Svalbard

Regulation on harvesting on Svalbard (FOR 2002-06-24-712) (only provisions and paragraphs that are especially relevant to the seal hunt are included)

Chapter I Introductory provisions

§ 1 Aim

Fauna has to be managed in order to provide for the species natural productivity, diversity and habitat are preserved, and so that the Svalbard wilderness are preserved for future generations. Within this frame a limited and controlled harvest can take place.

§ 2 Areas of implementation

The regulation applies for harvesting, and gathering of eggs and down, of wildlife, with exception of saltwater fish, crawfish and marine mammals that do not permanently inhabit Svalbard.

The regulation applies for the Svalbard territory and within the limit of territorial waters.

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Chapter II. General provisions on harvesting and gathering

§ 6 Humane harvesting and gathering

Harvesting and gathering shall take place without causing unnecessary suffering for the fauna and without any danger for people or property.

§ 7 Species and harvesting periods

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Ringed seal:	20 May – 20 March
Bearded seal:	5 June – 25 April

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Chapter III. Special conditions related to hunting and catching

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§ 14 Age limit for hunting and catching

…In order to hunt Svalbard reindeer and marine mammals the hunter has to be at least 18 years old.

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§ 15 Requirement for hunting licence certificate

All individuals over 16 years old and which is not yet registered in the Hunting register (*Jegerregisteret)* have to pass the hunting exam (*jegerprøven*) pursuant to this regulation before hunting or catching.

Individuals that are foreign residents do not have to pass the hunting exam (*jegerprøven*) if they can document that they fulfil the requirements to perform comparable types of hunt in their native country.

§ 16 Requirement for shooting test

It is prohibited to hunt Svalbard reindeer and marine mammals without having passed the big game shooting test. The shooting test is valid in one year. Hunting of Svalbard reindeer and marine mammals can only take place using the same weapon(s) that the hunter used during the big game shooting test.

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Chapter IV. Detailed specifications for the hunting test and big game shooting test

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§ 18 Completion of the hunting test

The hunting test consists of an obligatory course and a written exam. The Directorate for Nature Management decides who that can arrange the course and exam.

The obligatory course has to follow the arrangement approved by the Directorate for Nature Management. The course should be at least 30 hours over 9 days.

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§ 20 Completion of the big game shooting test

It is obligatory to carry through 30 training target shoots. Thereafter five shots has to be fired with each rifle that will be used during the hunt on a cardboard animal figure approved by the Directorate, with the same type of ammunition that are allowed used for the hunt of Svalbard reindeer and marine mammals. All five shots has to be inside the defined hitting area.

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Chapter VI. Hunting practice

§ 24 Artificial light ban

It is prohibited to use artificial light during the hunt.

§ 25 Ban against motor vehicles and aircrafts

It is prohibited during hunting:

a) to use aircrafts or motor vehicles for localising or pursuing of fauna or to divert the animal's attention
b) to fire shoots from aircraft or motor vehicles

…

§ 27 General weapon and ammunition demands

Only weapons charged with gunpowder can be used during the hunt.

Use of spring-gun and is prohibited.

...

the use of fully automatic rifles is prohibited.

When semi-automatic rifles are used, it is only allowed to carry two cartridges in magazine and one in the chamber.

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§ 28 Species specific demands for weapons and ammunition

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Only rifles shooting ammunition with expanding bullets shall be used for Svalbard reindeer and marine mammals.

For ammunition with bullet weight between 9 and 10 grams the impact energy has to be at least 2,700 joules (275 kilogram-meters) at a distance of 100 meters.

For ammunition with bullet weight 10 grams or more the impact energy has to be at least 2,200 joules (225 kilogram-meters) at a distance of 100 meters.

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