



**NORTH ATLANTIC MARINE MAMMAL
COMMISSION**

**REPORT FROM THE WORKSHOP ON
MARINE MAMMALS: WEAPONS, AMMUNITION
AND BALLISTICS**

Comfort Home Hotel Atlantic, Sandefjord, Norway
12 -15 November 2001

North Atlantic Marine Mammal Commission

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INTRODUCTION

At its 10th Annual Meeting held in Sandefjord, Norway 25-28 September 2000, the Council agreed to the recommendation from the Committee on Hunting Methods to hold a Workshop on Weapons and Ammunitions. The Council approved the following terms of reference for the Workshop:

- to increase the understanding of weapon types, ammunition and ballistics for hunters, administrators and other personnel, and
- to develop a minimum set of requirements pertaining to weapons and ammunition types with regard to different species.

In order to achieve this the Workshop would address topics such as:

- weapon types and ammunition in combination with terminal ballistics
- the impact of weapon types and ammunition on different marine mammals species
- safety for the hunters with respect to weapons use.

1. APPOINTMENT OF CHAIRMAN

Professor emeritus Knud Nielsen (Denmark) chaired the Workshop. He noted the following documents available to the meeting: List of participants (Appendix 1), Programme (Appendix 2), List of documents (Appendix 3), and Current Laws and Regulations in NAMMCO Member Countries (Appendix 4).

2. APPOINTMENT OF RAPORTEURS

Siri K. Knudsen (Norway) and Grete Hovelsrud-Broda (NAMMCO) were appointed as rapporteurs.

3. OPENING ADDRESSES

Jústines Olsen (Faroe Islands), chairman of the NAMMCO Committee on Hunting Methods, welcomed the participants and noted with satisfaction that several of the attendees had also participated at the first workshop of the Committee, in Nuuk, Greenland in 1999.

Knud Nielsen, chairman of the workshop, welcomed all the participants and noted the terms of reference for the workshop:

- *Increase the understanding and knowledge of weapons, ammunition and ballistic*
- *Formulate recommendations for weapons and ammunition for the different species.*

The workshop was aimed at hunters, administrative personnel and scientists, and was held in the Nordic languages, with simultaneous interpretations to English and Greenlandic, courtesy of the Canadian Embassy in Oslo and the Greenland Home Rule respectively.

4. PRESENTATIONS

4. 1. Ballistic by Egil Ole Øen (Norway)

Øen presented an overview over definitions in ballistic science and detailed information on internal ballistic (calibre, gunpowder, recoil), external ballistic (projectile trajectory, forces

that work upon the projectile, in fire of weapons) and ballistic tables (with several practical examples). The document was available to the meeting as NAMMCO/2001/HMWS-4.

Internal ballistic

1. *Calibre.*

Calibre is defined in a variety of ways, creating great confusion for those who attempt to find their way through this "jungle". The concept of calibre and calibre size are central terms within the science of ballistics. For all hand held weapons, except shotguns, the calibre describes the diameter of the barrel. Calibre .30-06 is for example one of the most commonly used calibres in the Nordic countries. Here the number .30 gives the calibre and refers to the hundredths (30/100) of an inch, while 06 refers to the year 1906 when this calibre was introduced in the US army. Calibre .30-06 is equivalent to calibre 7,62 x 63, where the number 7,62 is the diameter of the bullet in mm and the number of 63 is the length of the shell in mm. The minimum rifle calibre used in the Norwegian minke whale hunt is 9,3 (mm). However, most hunters now prefer larger calibre like .375 (9,5 mm) and .458 (11,6 mm). For harpoons the situation is easier. In the NAMMCO countries only three types of harpoon guns are used in whaling, i.e. 50 mm and 90 mm Kongsberg, and 60 mm Henriksen respectively.

2. *Gun powder*

There are several different types of propellant (gunpowder). The oldest and best known is black powder, which contains coal, sulphur and potassium nitrate. Black powder ignites easier than other propellants something that has caused several accidents especially in the production process. When the black powder combusts, large amounts of smoke and waste products are produced, and this may cause corrosion in the weapon if the weapon is not kept clean. The most commonly used propellant today is NC-propellant (nitro-cellulose propellant). It does not produce as much smoke at combustion and does not ignite as easily as the black powder, and it is therefore safer to use.

3. *The shot*

The ignition starts with a flash in the percussion cap in the shell. The gunpowder ignites and the fire spreads to the charge. Heat and gas cause increased pressure, and for ordinary hunting ammunition the pressure can reach a peak value of 3-4000 atm and temperatures over 3000° C. If the barrel is too long, the pressure will fall prematurely reducing the speed of the projectile. If the barrel is too short, the projectile will not reach maximum speed because of incomplete combustion of the gunpowder. If the barrel is not tight, some of the pressure will escape decreasing the speed of the projectile. To avoid this in harpoon guns a wad is used to tighten the barrel, made of porous plates, and a rubber plate is placed at the rear. It is very important that the rubber plate is placed in the rear and not in the front end of the wad as wrong position of the rubber plate will increase leakage and thereby reduce the speed of the harpoon.

4. *Recoil*

The recoil depends on both the weight of the projectile, the charge, the velocity and the mass of the weapon. The recoil from a handheld firearm is transferred through the weapon and to the shooter. The power and high pressure of harpoon guns demands special bars and anchorage points to intercept the recoil, in addition to contraption

devices that subdue the recoil inside the gun ("*recoil brake*"). The recoil brake consists of a feather and a liquid (usually glycerol and water, or oil). When a shot is fired the barrel is pushed backwards, and the recoil liquid and feather is compressed. If the feather is damaged the recoil will not be absorbed sufficiently, and the direction of fire will vary from shot to shot. This will also occur if the recoil liquid is of the wrong consistency and type, has wrong mixture or there are variations in outside air temperature. The same happens if the harpoon gun is not sufficiently fixed in the anchorage points and stay bars. In summary: if the recoil is not controlled, the accuracy of fire is decreased and the shot will go in a different direction than predicted and intended.

External ballistics

External ballistics deals with the projectile movement or course in air (projectile trajectory), as it leaves the weapon and hits the target. The projectile trajectory is influenced by a number of different factors. These include the various laws of nature (such as gravity and air resistance), the speed of the projectile (a high velocity projectile has a more flattened trajectory than a slow one), and the projectile shape (a pointed projectile has a more flattened trajectory than a rounded one, because the air resistance work harder upon the blunt one).

1. External ballistic related to rifle ammunition

For most types of hunting ammunition the projectile course will be relatively straight and flat the first hundred meters. On longer distances (for instance 200-300 m), the projectile will drop substantially. During hunting it is therefore advantageous to shoot at relatively short ranges to secure a straight course of the projectile. If one shoots at longer ranges, it is necessary to compensate for the predicted drop of the projectile, i.e. one has to aim higher. In shooting at close range (<25 m), especially when using telescopic sights, the situation is the opposite, and the projectile will hit below the sighting point. Most producers of commercially available rifle ammunition make ballistic tables for the projectile. These tables give the theoretical projectile trajectory, the velocity and the impact energy of the specific ammunition at different shooting ranges and during the most common temperatures and weather conditions. The tables are only general guidelines, and it is important to know that every projectile type will behave differently in different types of weapons. The only way to find the accurate projectile trajectory for a specific type of rifle ammunition or a harpoon is to do *extensive shooting tests for the most common shooting ranges and hunting situations* before the actual hunt.

There are several safety hazards connected with the use of heavy calibre rifles. The range of fire for commonly used hunting ammunition can be several thousand meters, and such projectiles might penetrate thick wooden walls or trees. A full metal jacket bullet of calibre .30-06, 9,3 mm, .375 and .458 may penetrate the deck and the hull of a boat.

The situation is different, however, if a projectile hits the water, it will quickly lose its speed and stop after a few centimetres (25-100 cm). It is therefore not recommended to shoot at an animal that is under water. On the other hand, if the projectile ricochets at the water surface it may go a long distance.

2. *Harpoons*

In principle, the rules for external ballistic also apply to harpoons. The major difference between rifle ammunitions and harpoons is the heavy weight and the relatively low speed of the latter, as is the maximum range (100-120 m). Consequently, the trajectory of harpoons will be much more curved compared to that of rifle projectiles. A harpoon will have a fairly flat course the first 20 - 30 meters, after which it will start to drop rapidly as the speed is reduced. When the harpoon hits the water, the water will cause the harpoon to slow down, but because of the heavy weight the reduction will not be as substantial as it would be for rifle projectiles. Harpoon trajectory under water will much depend on the form of the tip of the harpoon. Shooting tests conducted by Øen have shown that pointed harpoons will easily ricochet at the water surface or deflect upwards against the water surface the first 5-6 meters. A harpoon with a flattened or concave nosepiece (like the Norwegian harpoon grenade) will not skid or deflect but, continues in the shooting direction for the first 5-6 meters in water after which it rapidly moves downwards.

The weight of the attached line (forerunner) also decreases the velocity of the harpoon. A positive effect of the forerunner is that it will contribute to stabilising the harpoon and to prevent it from tipping. It is important for the accuracy of the shots that the forerunner is placed close to the harpoon and that it is tightly coiled up to prevent the line from winding.

The two most important factors in ensuring accuracy of firing harpoons are the exit velocity of the harpoon and the stability of the canon and its anchorage points. Relatively small changes in velocity will cause major changes in the harpoon trajectory and consequently the target point. If the gunner use harpoons of varying weights, if the harpoons are somewhat bent and do not fit snugly in the barrel, if the harpoon is not resting against the wad making an air pocket between the wad and the end of the harpoon, or if the propellant charge has some dysfunction, the exit velocity will be markedly reduced. Instability in the canon will always affect the accuracy of firing, even on very close ranges.

The following conclusions were made:

A good and predictable hunter will ensure that:

- The harpoon gun, with stay bars and anchorage points, are in good condition
- The weapon is sighted in before the hunt
- The sights are adjusted to the most common shooting range
- The harpoons have the same weight
- The harpoons are straight and fits tightly in the barrel
- Only lines (forerunners) of the same weight are used
- Knowledge of basic ballistic of the weapon in use
- Knowledge and experience on how to adjust to different shooting ranges and angles

Questions, comments and discussion

Jan Olsen (Norway) pointed out that it is important to not use worn-out shells in the harpoon gun, as they might no longer be sufficiently tight. He noted that there have been some difficulties in Norway in providing new casings to replace old worn-out ones.

Øen (Norway) commented that to evaluate the recoil and stability of the harpoon gun, a simple test might be performed by applying an electronic component on the gun attached with a plastic tape, which can register the stretch in the stay bars or in the gun. By changing the position of the electronic device, all parts of the harpoon gun can be controlled, including the deck.

Øen (Norway) also commented that the viscosity of the liquid used to subdue the recoil of the harpoon gun changes with different air temperature. Ideally it should have a certain thickness, and according to varying air temperatures this can be achieved by changing the mixture of glycerol and water. A common used mixture is two parts of glycerol and one part water, but if it is cold, this mixture can be too thick because of too low water content. On the contrary, at higher temperature the amount of water may have to be decreased. To control the recoil will not only increase the accuracy of the shot, but also the safety of the operator.

Olsen (Norway) asked whether the use of pointed harpoon grenades had been evaluated. Øen (Norway) answered that pointed harpoons (like the old cold harpoons) ricochet more easily than the blunt ones (like the penthrite grenade), something several investigations have confirmed. In the pelagic large whale hunt they started to use blunt nosed harpoons, rather than pointed ones, as early as in the 1950s. It was only in the minke whale hunt that the pointed harpoons were used after 1952.

4. 2. Terminal ballistics, by Egil O. Øen (Norway).

Terminal ballistics is a part of external ballistics, and is the same as target ballistics. This lecture dealt in particular with terminal ballistics related to rifle ammunition. The document was made available to the meeting as NAMMCO/2001/HMWS-5. The difference between full metal jacket rounded bullets and expanding soft nose bullets was emphasised. The formation of the temporary and permanent wounding canal was explained, and also certain factors that are important for the mechanisms of wounding (such as shock effect, impact energy, calibre, weight and form of the projectile).

Rifle ammunition

There are in principle three different kinds of projectiles for rifles

- a) *Full jacket*. These projectiles consist of a soft core of leaden or a plumbiferous alloy, surrounded by a capsule of hard metal that is open at the end. The nose of the projectile may be pointed or rounded. Full jacket projectiles will in most cases penetrate deep into the animal without the bullet being damaged or deformed.
- b) *Soft point bullets*. Consist of a soft core of lead surrounded by a hard metal capsule with an open nose and closed back. These projectiles will crack in front at impact and expand causing maximum tissue damage as it passes through the tissue.

- c) *Full metal*. Lead or other metal. Often used in low calibre rifles (like "Rim fire"). Full metal is also used for other hunting purposes (Barnes) but will not be dealt with in this lesson.

The effect of calibre, weight and form of the projectile on the wounding mechanism

A projectile with heavy weight will generally penetrate deep into the tissue, but other factors are also important, i.e. the form of the projectile and the impact energy. If the projectile is sharply pointed it will easily penetrate through soft tissue like musculature, but if it hits bony tissue it will easily splinter, ricochet or capsize against the bone. A round nosed bullet, however, will provide larger forces and will not splinter as easily. For the larger species of whales the skull bones are thick and compact, and one should therefore only use heavy, full metal jacket round nosed bullets to be sure that the projectile penetrates the bone and enters and damages the brain. In comparison seal skulls are relatively thin, and softer projectiles that expand rapidly are preferred. The penetration abilities of the projectile are also dependent upon the relationship between the weight and the cross section of the projectile.

4. 3. Terminal ballistic – what happens inside the animal? by Siri Knudsen (Norway)

Soft-tissue ballistic wounds

Ballistic wounds in soft tissue (skin, fat, and skeletal muscle) usually consist of the following components from inside out: 1) the permanent cavity, which is a hole containing blood clots, detached chunks of tissue, and foreign material that may have been aspirated or carried into the wound; 2) the zone of extravasation (bleeding zone), which consists of haemorrhages and shredded, pulped muscle around the permanent cavity; and 3) the zone of concussion, which is grossly normal muscle, but under microscopy damages such as haemorrhage, vascular congestion, and abnormal muscle cells are evident. This document was available to the meeting as NAMMCO/2001/HMWS-6.

Organ-specific wounds

The different organs in the animal body have different structure and qualities, which affect the mechanism of wounding and wound-ballistic characteristics. Some organs have no room for expanding, and the energy waves released from the projectile will cause so called *explosive* damage.

1. Ballistic wounds in the skull and brain

Shots fired at the brain will in almost all cases be grossly destructive and cause very traumatic damage and instantaneous death. The brain is vulnerable because it is enclosed in the heavy bones of the skull and there are no opportunities for the tissue to expand. At impact the pressure inside the skull will consequently increase dramatically. Additionally, the brain tissue itself is not elastic and shots to the brain will therefore in most cases be of an explosive character. If the pressure at impact is high the brain will be blown away and pressed through natural openings like the sinuses or the foramen magnum. At very high pressures the cranium itself can crack, and fractures and bone splints can cause secondary damage to the brain. The brain stem is the area most sensitive to increased intracranial pressure. Because the brain tissue has a rigid nature and the brain is enclosed in a closed container, a projectile does not have to hit the brain directly to cause devastating injury. Shock waves created from an impact in an area close to the brain may be sufficient to cause bleedings and crushes

due to increased intracranial pressure in vital areas in the brain, and the outcome may be fatal.

2. *Ballistic injuries in the chest*

The major organs in the chest (the lungs and the heart with its major blood vessels) tolerate ballistic injury differently.

Resistance offered to the passage of a projectile will be low if the target's density is low. The lung tissue has very low density compared to other organs in the body, thus energy transfer and tissue damage in the lungs may be small. The lungs, being relatively elastic, are also easily stretched compared to other organs. As a result of these physical properties, the lungs have considerable tolerance to the stretch and shear of temporary cavitation. This does not mean, however, that the temporary cavitation cannot be a destructive process in lungs. Projectiles with high-energy transfer are more than capable of causing severe damage to the lungs.

The heart and major vessels. Wounds to the heart are frequently as destructive as wounds to the skull. The catastrophic injuries often encountered after wounding of the heart is mainly due to temporary cavitation occurring in a fluid-filled organ. The large vessels, like the aorta and the pulmonary artery, are susceptible to the same catastrophic damages as the heart

3. *The abdomen*

The internal organs in the abdominal cavity can be divided into two classes: "dense" or solid organs (such as the liver, kidneys and spleen), and "hollow" organs (urinary bladder, stomach and intestines). Both types of viscera can respond similarly when penetrated by a high-energy-transfer projectile. The dense organs are highly vascular (rich in blood), and friable (i.e. the tissue lack elasticity and tear easily when stretched). The formation of the temporary cavity will cause severe tissue disruption in these solid organs. A high-energy-transfer projectile will cause a very large permanent cavity, which in most cases nearly matches the size of the temporary cavity. Such injuries are rapidly fatal. The gastrointestinal tract is totally different, because these organs are either filled with air or gas, and the tissue is relatively tolerant to stretching. If the gastrointestinal tract is empty, the wound's permanent cavity will probably be the same as the projectile. If the system is fluid- or gas filled, however, the potential exists for severe disruption. The abdomen is one body region in which damage from indirect effects may be common. Hits in these organs will initially seldom be fatal (Harvey *et al* 1962).

Effects of the heavy calibre rifles used as secondary weapon in the Norwegian minke whale hunt

Knudsen presented a study on the effect of the rifles used as secondary weapon in the Norwegian minke whale hunt. The results showed that the heavy calibre (min. 9.3 mm and upwards), with round nosed full metal jacket bullets, are efficient in killing minke whales by a shot to the brain.

Effect of the penthrite grenade for minke whales – blast injuries

Explosives and shock waves.

An explosive is a substance that can be made to undergo a rapid chemical reaction transforming a liquid or solid into gas, and thereby liberating a large amount of energy. The products of the detonation (or explosion) of a conventional explosive are a) a region of highly compressed gas (the blast) that rapidly expands, and b) various solid residues from the explosive or its casing. The rapid expansion of gas after detonation almost instantaneously compresses the surrounding air into a shock wave that propagates supersonically (faster than the speed of sound) and in all directions from the explosion site.

The explosive used in "Hvalgranat-99" is penthrite. Penthrite is a commonly used explosive that detonates at a supersonic speed of about 7,000 m/s. On detonation, the volume of the gases produced is over 6,000 times that of the original mass. The pressure produced by 1,000-g penthrite in a closed system is about 14,800 atmospheres. Penthrite is non-toxic, and on detonation it decays into natural gases and water. The damages seen after detonation of penthrite explosives, are mainly caused by these shock waves. When a blast strikes the body, over-pressure waves propagate in tissue at the speed of sound and cause damage to organs similar to that caused by blunt trauma. The body wall is displaced, resulting in a rapid change of organ volume, displacement of organs and potentially lethal stretching of tissues. After and between these pressure waves, sub-atmospheric pressure waves arise, causing gas-filled organs to expand as the outside pressure falls.

Detonation of the penthrite grenade

Injuries after explosions described in various literatures are based on the experience from wars, terror attacks, and accidents. In most cases these descriptions are strictly related to injuries caused by detonation of an explosive outside the body (i.e. extra body blasts). The damages described in humans after heavy blasts are lung damages, rupture/tearing/perforation of various internal organs, and heart failure. It is logical that the effects of an intra body detonation, which is the case with the detonation of the penthrite grenade, give at least the same or even more extensive organ damage. Øen has studied the damages caused by the penthrite grenade, which show that the damages in many respects were similar to those described in humans and experimental animals killed by blasts (Øen 1995). The best way to describe the effect of the penthrite grenade is mass-trauma or multi-organ injuries. Studies on the effect of the penthrite grenade have continued, and during the last 4 years extensive pathological studies have been carried out on minke whales killed by penthrite grenades. The results from this study are not yet finally analysed. So far the results support the previous work done by Øen. The preliminary results from thorough examinations of the whale brains indicate that the grenade has an effect on the central nervous system even if it detonates at some distance away from the brain. The injuries registered so far are bleedings of different size (from very massive to those only recognised by microscopy) in vital brain areas, including the brain stem.

In concluding the lecture Knudsen emphasised the points on how to kill an animal most efficiently and painlessly: The most effective way is to damage the brain stem/upper cervical spinal cord or central parts of the brain. An instantaneous loss of consciousness will occur when these parts of the central nervous system are damaged. Damaging of the heart or major blood vessel will cause rapid loss of consciousness.

Questions, comments and discussion on the two above presentations

The Chairman noted that that this was a follow-up of the discussion at the Workshop in Nuuk on different bullet types for the different species. A discussion followed in which Øen pointed out that when shooting a whale in the head, full metal jacket blunt nosed bullets were the most efficient ammunition. In seal hunting pointed expanding ammunition would be sufficient, because seals have softer skulls. In a study on seals the results showed that of 348 animals 342 died instantly with this type of ammunition. In fifty percent of the cases the brain had vanished completely. In whales, this type of ammunition will not penetrate the neck vertebrae and will skirt the outside of the brain case. Øen further informed that in Chukotka in the Russian Arctic the hunters aim at the brain from the side of the animal. Studies of these whales showed that the lead pointed small calibre ammunition had not penetrated and were found resting on the outside of the skull. Ole M. Myklebust (Norway) noted that even blunt lead tipped ammunition did not penetrate the skull of minke whales. Øen pointed out that smaller animals would be killed instantly with this type of ammunition. Calibre .458 could potentially be sufficient on gray and sei whales if the hunter knows exactly where to shoot.

Sigurd Grundvig (Norway) informed that calibre 9.62 is allowed in the minke whale hunt in Norway, but that it is no longer produced in full metal jacket. It is currently only available with a lead tip. He also pointed out that he is most satisfied with the ammunition that he makes himself.

Nikolaj Heinrich (Greenland) agreed that it is crucial to hit a whale in the brain, but when shooting from small vessels the hunter must aim for the ear.

Øen responded that it is even more difficult to hit the correct area when shooting from the side. In addition the ear bone is thicker. These two factors combined indicate that the hunter should use full metal jacket ammunition.

Bjørne Kvernmo (Norway) informed that it was no longer possible to purchase ammunition specially made for seal hunting.

The hunters all agreed that it is crucial to find the best ammunition that will kill the animal as quickly as possible and that cheaper ammunition is of a lesser quality.

The Greenlandic hunters noted that such discussion were very useful.

4. 4. Anatomy: Anatomical features of different animals in relation to hunting

A. The anatomy of pilot whale, killer whale, northern bottlenoses whale, and white-beaked dolphin, by Jústines Olsen (Faroe Islands)

Pictures and illustration charts for different species were presented. The following points were emphasised: As a general rule the brain is always situated behind the eyes. The brain is not situated in the melon, which is often misunderstood by many people. The important external features to help locate the brain in whales are the blowhole, the eye and the rostral edge of the flipper. In the pilot whale the brain is situated from the eyes/blowhole in the rostral end and approximately a hand width behind the blowhole. In the bottlenose whale the brain is situated

from the eye/blowhole in the rostral end and approximately an arms length (i.e. from the elbow to the fingertip) behind the blowhole. Generally for all the toothed whales the shape in the form of crests and ridges on the skull bones may cause the projectile to ricochet, and therefore it might be advisable to shoot the animals from behind to hit the oblique surface in the occipital region of the skull. The pictures and illustration charts are available at the website hval.djoralaeknin.com

B. Minke whale, fin whale and seals, by Siri K. Knudsen

Pictures and illustration charts with emphasis on the vital organs (brain and heart) were presented for the three species.

The brain of an average size minke whale is approximately 20 cm long and 22 cm wide. In relation to the external features the brain is situated as far behind the eye as the blowhole lies in front of the eye. The gunner has to estimate the relative position of the brain, and change the aiming point according to the whale's different positions in the water and varying shooting ranges and angles. An illustration chart with position of the brain of the minke whale has been distributed to all the Norwegian whaling vessels. The heart of the minke whale is situated in the lower thorax, and the external mark is the white spot on the flipper.

C. Sperm whale, by Egil O. Øen

In sperm whales there is a large area of the head, the spermaceti organ, where shooting is futile. The sperm whale will often lie on its side when it strands. A .458 calibre rifle with full metal jacket round nosed bullet may be sufficient to kill a sperm whale if the brain is hit. To locate the brain one should draw an imaginary vertical line through the eye, and a similar vertical line through the rostral tip of the flipper. The brain is situated in the middle of these two lines.

D. Beluga and narwhal, by Ole Møller, KNAPK, Greenland

Figures and illustrations of the two species were presented, and the aiming points were highlighted. The brain is situated in the midline between the tip of the flipper and the eye. In the beluga hunt the hunters primarily aim for the brain, secondarily the heart and as a last resort if the animal dives, the kidneys.

Questions, comments and discussion

Øen (Norway) reminded the Workshop that if the head of a whale is inaccessible (for instance under water), a hit from a rifle bullet in the heart with a heavy calibre rifle kills the whale even if the death will occur slower than from a hit in the brain. He further commented that a hit in the kidney would cause rapid death provided that the renal arteries are wounded.

In response to a question from the Chairman about ammunition used in the Greenlandic beluga and narwhal hunt, Møller (Greenland) explained that in the narwhal hunt mainly calibre .375 and .458 with expanding soft nose bullets are used. In previous years, .308 was also quite commonly used. Panigpak Daorana (Greenland) and Heinrich (Greenland) noted in addition that in the beluga and narwhal hunt the hunters attempt to hit the brain stem, rather

than the brain. Experience has shown that this will render the animal instantaneously unconscious, immobilised and floating. Small animals may be shot in the brain, but it is preferable to hit the medulla/upper spinal cord. When hand harpoons are used the target area is the heart. As the most important point is to secure the catch, most hunters will not shoot at an animal that is diving.

Olsen (Faroe Island) inquired what the most common shooting ranges were in the narwhal and beluga hunt in Greenland. Heinrich (Greenland) responded that because narwhal are not shy they are often hit point blank, while the beluga often dive if the hunter comes too close, and are therefore shot at a greater distance.

Glenn Williams (Canada) gave a short presentation of the narwhal and beluga hunt in Nunavut. There the whales are hunted under different circumstances during the year: near the ice edge, in open water and in solid ice through breathing holes. In the open water hunt several small boats co-operate. The animals are harpooned at close range. The challenge for the narwhal hunter is to pick the correct time to shoot. During the ice edge hunt, the hunter waits for the animals to expose it self and shots are fired at the animal only from the side aiming at the neck of the animal. To retrieve the dead animals from the ice edge either handheld harpoons are used, or more popular a grasping device with a long line, which is [thrown over the animals, and hooked]. When hunting on solid ice, the animals are shot when they come up to breathe between the cracks. The most commonly used weapon is .338 Winchester with Magnum and Barnes bullets (solid copper), but calibre .375 is also used. The hunters prefer soft nose bullets because the full metal jacket passes right through the animals.

Upon request Øen (Norway) gave the percentage of minke whale killed instantaneously in the Norwegian hunt: In 1999 the number was 73% and in 2000 78%. The results from 2001 are not yet fully analysed.

Øen (Norway) explained that after detonation of the old penthrite grenade a distinctive smell could sometimes be registered in the detonating area. This was due to the vinyl in the penthrite fuse. In the new grenade ("Hvalgranat-99") the penthrite is pressed into a capsule of polyethylene, which will not evaporate, or give any smell or taste. When detonating the penthrite will combust into non-toxic natural gasses (like CO₂, CO, O₂ etc.) and water.

4. 5. Weapons and ammunition

A. Test shootings with rifles and captive bolt pistol on dead pilot whales, and use of bolt pistol in the pilot whale hunt (NAMMCO/2001/HMWS-7), by Jústines Olsen (Faroe Island)

At the workshop on Hunting Methods held in Nuuk 1999 it was recommended that the Faroe Islands should consider using rifles in killing stranded bottlenose whales. So far no carcasses of bottlenose whales have been available for testing such rifles. As a response to the recommendation, a study was conducted with sighting shots on the heads of several dead pilot whales of different body size and with different weapons and ammunition. The weapons used in the study were two rifles of calibre .458 and .308 respectively, and a bolt pistol with a diameter of 11 mm and with length 70-mm. The ammunition used were .458 WIN Magnum, solid round nose, full metal jacket; .308 Norma Sharp Point, full jacket; .308 WIN Remington, soft pt.; and Cattle killing cartridge, blue for heavy oxen. The results were

documented with photos, and these are available at hval.djoralaeknin.com. The following conclusions were made: Rifle with calibre .458 with solid round nose, full metal jacket bullets may be used for killing pilot whales of all sizes with a hit to the brain. Based on the results it is likely that this calibre and ammunition is suited for the killing of other whale species of the same size as the pilot whale. Rifle with calibre .308 and the two projectile types tested is sufficient to kill small pilot whales, but further studies have to be conducted on the largest pilot whales. The major concern in using firearms in the pilot whale hunt is the safety hazard for the operators and participants in the hunt. The bolt pistol is efficient in killing small pilot whales (up to 4 "skinn"¹), but the method is not applicable under the practical circumstances in the pilot whale hunt on the Faroe Islands.

B. Weapon and ammunition in the Norwegian seal hunt, by Egil O. Øen (Norway)

Øen referred to an earlier pilot study on the "*hakapik*", which have proven to be an effective weapon for the killing of young seals. The skulls of young seals are thin and are easily damaged from the blow of the *hakapik*. The crucial factor is that the hunter knows where to hit to damage the brain, and that the hunter is well trained. In Norway annual courses are held for the hunters prior to the seal hunt. Øen also referred to an unpublished study, which he had conducted on the use of calibre .222 and .223 by four different hunters on 248 young seals (< 1 year). The results showed that 98,6 % of the animals died instantaneously, and in a majority of cases the brain was blown away. The seal hunting regulations in Norway demands that the *hakapik* be used after the animals are shot. This might be considered odd for the hunter when the whole brain has been destroyed and blown away by the rifle shot. It is likely that these regulations will be evaluated soon.

In Norway there is also a small-scale coastal hunt of seals. With respect to calibre and ammunition types the regulations are the same as for hunting seals on the ice, but there are no requirements to use the *hakapik*. The seal hunt along the Norwegian coast is likely to be intensified, and this might contribute to improving the regulations, including that of hunting on the ice. As a principle one should seek to have the same kind of regulations and requirements for the same species.

C. Weapons and ammunition in the Norwegian minke whale hunt, Egil O. Øen (Norway)

The hunt is carried out from small fishing boats, which are rigged and equipped for minke whaling in the hunting season. Each boat has a harpoon gun mounted on the bow. The harpoon is equipped with a harpoon grenade with the detonating explosive penthrite. From the whaling season 2000 the new penthrite grenade ("Hvalgranat -99") has been the only one permitted, and the older types of grenades are banned. In addition to the harpoon gun, each vessel is required to carry a rifle of minimum calibre 9,3 mm, to be used as a secondary weapon in ensuring that the whale is dead. This is done by a shot to the brain. The bullets have to be solid, full metal jacket and round nosed. Hunters should be aware of the fact that bullets of this and larger calibre is available in many different qualities. And it is often the case that the cheaper ones are of lesser quality.

¹ A method for measuring the size of pilot whales.

D. Weapons and ammunition in the seal and whale hunt in Greenland, by Nikolaj Heinrich, KNAPK (Greenland)

It was emphasised that seals are important for Greenlandic culture and remain an important source of food and clothing. In the past seals were also an important source of heating and tools. Seals, beluga and walrus have traditionally been hunted with handheld harpoons from small boats. Today several types of rifles are used in the hunt.

In the seal hunt calibre .222 and .223 with expanding soft nose bullets are most common. It is often observed that the whole brain is blown away when using these calibres. For ringed seals lower calibres such as .22 and .22 Magnum are sometimes used, because these seals are often hunted in the water and their heads are easy to hit. These lower calibres also create less noise. However, most hunters choose calibre .222 and .223 for ringed seal. Currently there is no regulation in Greenland stipulating a minimum calibre for seal hunting, but this is likely to be introduced soon.

In beluga and narwhal hunting most hunters prefer to use full metal jacket bullets. The minimum allowed calibre to use on narwhal, walrus and beluga is .30-06. There have been problems in the past with retrieving heavy calibre rifles, but today hunters can purchase rifles of calibres .308, .375 and .458. The beluga will die instantaneously if it is hit in the brain or upper spinal cord. Most of the hunt is carried out from small boats, but hunting from the ice edge also takes place, especially in the fjords.

In the rifle hunt of minke whales the minimum calibres allowed are .30-06 or 7,62.

Greenlandic hunters sometimes find it difficult to accept that new regulations pertaining to weapons and ammunition are being made, but experience shows that when the legislation has been passed the majority respect these rules.

Questions, comments and discussion

The Chairman raised the issue of the possibility to make recommendations for the different species that could be implemented in all countries. The chairman acknowledged Norway for its work on the development of the new penthrite grenade that has further increased the number of whales killed instantaneously and has also improved the safety of the operator considerably. Norway was also acknowledged for its scientific ballistic studies of the penthrite grenade and heavy calibre rifles used in the minke whale hunt, and for their studies on seals.

Amalie Jessen (Greenland) pointed out that in Greenland it would be difficult to implement weapon recommendations in the legislation because there are great difficulties in providing the desired ammunition to the hunters, simply because it is not available in the stores. In particular, this is a problem for the hunters who live in the remote villages throughout Greenland. She noted that it is unfortunate that price politics and commercial availability affects the choice of weapon and ammunition.

Øen (Norway) gave credit to the Faroese rifle study on the pilot whales presented by Jústines Olsen (Faroe Island). This presentation showed that very valuable results could be obtained at

relatively low cost and by using simple, but standardised procedures. Similar studies under controlled circumstances are the only way to confirm the killing efficiency of a weapon and its ammunition. It would be interesting to do similar studies in other species, such as the beluga, narwhal, walrus and seals. Such scientific studies, combined with the experience of the hunters, could provide the basis for the development of recommendations.

Jessen (Greenland) agreed to the usefulness of performing this type of studies on other species like beluga, narwhal and walrus.

Siverth Amundsen (Greenland) emphasised that specific ammunition requirements must not create a conflict with the most important factor of the hunt: to secure the catch. He noted that it was important not to draw any preliminary conclusions with regard to ammunition recommendations for the Greenlandic hunt. He also noted that it was important that the experience and knowledge of the hunters were taken into consideration. He further agreed with Øen, that it would be useful to do ballistic studies on different ammunition types for the different species.

Øen (Norway) emphasised that the only effective rifle ammunition for large whales, like the minke, are minimum calibre 9.3 mm with solid, round nosed, full metal jacket bullets.

Grundvig (Norway) explained that it is possible for hunters to manufacture their own ammunition, since the ones available in the stores are not always of the best quality. He also referred to a previous lecture about different types of ammunition and noted that for the full metal jacket bullets there are two types: thin and solid. The thin ones are excellent for test shooting, since they are much cheaper. The solid type is used in the Norwegian minke whale hunt because it is the only one that penetrates the brain. He explained that some Norwegian hunters started to use these bullets already in the early 1970s. With regard to pointed bullets with lead, there are at least 100 different types, and it can be difficult for the hunter to know which type to use. In the seal hunt one aims for the brain and bullets with rapid expansion are preferred. If the heart is the target (like in big game hunting) a bullet with a somewhat lower expanding rate is preferred. The latter may also be used for firing at the brain, while those with rapid expansion are not recommended when aiming at the heart.

Åke Granström, director of the Swedish Association for Hunting and Wildlife Management, gave a short presentation about the requirements on weapons and ammunition for the planned seal hunt in Sweden and Finland. Minimum recommended calibre for seal hunting in Sweden is 6.5 mm with a bullet weight of minimum 9 g. The corresponding requirements in Finland are calibre .222, but also "slugs" are permitted for gray seal hunt. With reference to the Swedish seal hunt, the Association was very interested in the Norwegian studies and in the information that can be used in the training of hunters. In the Swedish hunt the safety aspect will be very much emphasised, since much of the hunt is carried out in an area where there is heavy traffic of both people and boats.

Williams (Canada) raised a question about bullet characteristics in water, and noted that more research was needed on this topic. Øen (Norway) responded that the way bullets act in water depends on a lot of factors. In the 1980s Øen did several experiments and studies on 22-mm high-velocity projectiles on minke whales, which showed that after 30-50 cm in water the

projectile was not able to penetrate the blubber. Øen also reiterated that it is not recommended to fire at animals that are under water.

4. 6. Sights and sighting implements, Torkil Hopmark, whaler (Norway).

Egil O. Øen (Norway) presented the lecture on his behalf because he was unable to attend the meeting.

There are three main types of sights that might be used for whale and seal hunt:

- Open sights (such as for the harpoon gun). These sights are quick to use, in general rough, and especially good for short range shooting.
- Peep sights consist of a ring and a foresight. Commonly used on sharpshooter rifles. The disadvantages are that they are not efficient to use and are less suitable for shooting on short distances than open sights.
- Telescopic sights. There are two main types: cross-hair and aim-point sights. The latter is not a true telescopic sight. These sights are reliable, accurate and easy to get used to. The disadvantages are that they are vulnerable to weather and water, and may be unstable under rough conditions. In Norway aim-point sights seems gradually to take over for the open sights on the harpoon gun, especially on boats with young gunners.

Øen stressed that regardless of type of sights being used, it is extremely important to sight in the weapons, both harpoon gun and rifles, on the most commonly used shooting range and with the ammunition or harpoons that will be used during the hunt.

Questions, comments and discussion

Ole M. Myklebust (Norway) informed about the work some Norwegian whalers have been doing on improving the sights for the harpoon gun by modifying the open sights to improve their accuracy. It has proven successful to use cross-hair sights as foresights in combination with open rear sights. He also emphasised that with these kind of modified sights it is very important to sight in the harpoon guns prior to the hunt focussing on the most common shooting ranges.

4. 7. Maintenance, inspection and overhaul of weapons and other hunting equipment

In Greenland, by Peter Siegstad, KIS-Konsultant (Greenland)

Due to safety reasons the introduction of the penthrite grenade in Greenland in the late 1980s made it necessary to renovate and standardise the harpoon guns. A document describing the renovation and standardisation program was available to the meeting as NAMMCO/2001/HMWS-8. All harpoon guns were therefore overhauled during the years 1995-1998. At the same time a detailed manual on maintenance and overhaul of the harpoon gun has been produced and distributed to all the owners of such guns. Furthermore, all gunners have attended obligatory courses. In addition to the maintenance and control done by the owners, the harpoon guns undergo a full overhaul by experts (Grønlands Værfter) every second year. Only experts that are licensed operators and approved by Grønlands Værfter are

allowed to make any repairs of the harpoon guns. If the harpoon gun is sold or transferred to a new vessel it has to be mounted by an authorised operator. Consultants from KIS travel throughout Greenland teaching and advising in the use of the harpoon gun. Special attendance is given to new hunters.

In Norway by Torkil Hopmark.

(In Hopmark's absence Egil O. Øen (Norway) presented the lecture)

Because of two serious accidents with the 50-mm Kongsberg harpoon gun in Norway since 1998, the work to develop procedures for maintenance and overhaul of the Norwegian harpoon guns has been intensified. A working group consisting of hunters and weapon experts has now made a log book/service pamphlet that will follow each harpoon gun. This manual has been sent to the authorities (Ministry of Fisheries) for evaluation. Requirements for maintenance and repair procedures for the harpoon gun may also be included as a part of the hunting legislation and regulations in the future.

With respect to maintenance of the harpoon guns, Hopmark emphasised the importance of washing the harpoon gun after each season, preferably with a pressure washer and treat it with a rust-preventing agent afterwards.

Questions, comments and discussion

The Chairman Nielsen (Denmark) complemented Greenland on the substantial work done by the authorities, weapon experts and hunters in renovating the harpoon guns, acknowledging that this has been a costly process. Øen (Norway) also complemented the work in overhauling the Greenlandic harpoon guns, and noted that Greenland probably has the best harpoon guns in the NAMMCO countries today.

Jessen (Greenland) informed that in Greenland the making of a new instruction video on the use of the new penthrite grenade ("Hvalgranat-99") is under consideration. The plan is to distribute the video to all gun owners and shooters. This was also done previously with the old grenade together with courses in its. Emphasis is given to teaching and informing the new hunters. The Greenlandic Home rule Government currently subsidises the purchase of whale grenades with fifty percent of the cost, a program that is likely to continue in the future.

Heinrich (Greenland) informed that the renovation of the harpoon guns in Greenland had been very useful, but that it also had been very expensive for the gun owners (costing about three times the price of a new harpoon gun). He noted that most Greenlandic hunters maintain their own weapons, because they are dependent upon them. He explained that he still could hunt with his 25-year-old rifle because it has always been kept in good condition. He emphasised that an efficient hunt depends on well-functioning and maintained weapons.

Jan Kristiansen, chairman of the Norwegian Whalers Association, explained, on the basis of personal experience, that proper maintenance of the weapons is crucial for safety. He expressed his support for the development of the logbook for harpoon guns that will enable the hunters to perform regular control and maintenance. He also posed a question to the Greenlandic hunters whether they make their own spare parts for the 50 mm canon. Siegstad (Greenland) responded that they could produce spare parts for the canons in Greenland, but

that they also purchase these from Henriksen Mek. in Norway or from Denmark depending on costs and delivery time.

Møller (Greenland) asked whether the Norwegian authorities have hired a weapon and ammunition advisor or consultant such as Peter Siegstad in Greenland. Øen (Norway) responded that no such permanent advisor exists today and that the Greenlandic system is better than the Norwegian in this respect. However, during the annual courses for the minke whale hunters in Norway weapons experts are present to advise the hunters.

With respect to spare parts for the harpoon guns Øen (Norway) emphasised that economic considerations should not reduce the quality and safety of the canons. Experience shows that in most cases original parts should be used.

Myklebust (Norway) stressed how important it is that the harpoon guns fits the barrel of the harpoon guns to secure the stability of the shot. He explained that he has had success, on his boat, in placing an extra rubber plate behind the harpoon and one rubber plate in the middle of the harpoon to stabilise it.

4. 8. Safety aspects and animal welfare concerns

Olsen (Faroe Island) explained that in the pilot whale hunt the introduction of firearms would create a major safety hazard. This is due to the number of people involved in the hunt (often the whole community) and the very restricted area (a small beach) where the hunt takes place.

Øen (Norway) referred to his earlier lectures, and repeated the most important elements: The introduction of "Hvalgranat-99" represents a substantial improvement both with respect to safety concern for the operator and to animal welfare. Today nearly 80% of the whales are killed instantaneously. With respect to safety concerns the major difference with the new grenade compared to the old ones, is that there is no longer any danger for blind shells/duds (grenades that do not explode upon impact). The old grenade is no longer allowed in the Norwegian minke whale hunt, and safer gunpowder is sought to replace the black powder. He also repeated the safety hazards related to the use of heavy calibre rifles, especially while hunting from a boat. A shot from these rifles is more than capable of penetrating the deck of the boat, and in free air it may travel several thousand meters. The Norwegian hunting regulations stipulate that the rifles are kept at the stand on the front deck near the harpoon gun to prevent personnel traffic around loaded weapons. This regulation was also considered an animal welfare issue. If the grenade does not instantaneously kill a whale, it is also shot with the heavy calibre rifle as soon as it is hauled near the boat.

Jessen (Greenland) informed that the Greenlandic authorities are considering buying the old grenades from the hunters to prevent their use because of the safety risks involved.

The chairman (Knud Nielsen) and several others commented that sometimes compromises have to be made with respect to safety - versus animal welfare considerations. It was emphasised that no hunting regulations should be drafted that could lead to any safety risks for the hunters and the operators. Furthermore, it was commented that the weapons and ammunition should be chosen based on the knowledge of their efficiency on particular

species, and that equipment and hunting methods have to be adjusted to each circumstance in order for the catch to be secured.

5. CLOSING STATEMENTS

The Workshop Chairman, Knud Nielsen (Denmark) summarised the work that had been done at the Workshop. He expressed his satisfaction with the unanimous decision to approve the recommendations. In conclusion he thanked everyone that had contributed and participated in the Workshop.

The chairman of the NAMMCO Council, Amalie Jessen (Greenland) expressed her appreciation for the Workshop and thanked all the participants for their contributions.

Mr Esbjörn Johanssen, the Swedish Fisheries Association (Sveriges Fiskares Riksförbund) expressed his appreciation for having been invited and noted that the Workshop had been interesting with informative lectures focussing on a number of issues of interest to his organisations.

In conclusion the chairman of the NAMMCO Committee on Hunting Methods, Jústines Olsen (Faroe Islands), thanked Mr Nielsen for his excellent chairmanship, and the presenters, participants and the rapporteurs for their efforts. He also thanked the NAMMCO Secretariat for effectively organising the Workshop, and lastly and especially Dr Øen for his professional guidance in preparing and executing the Workshop. He noted with appreciation the participation of guests from other countries outside NAMMCO, and acknowledged the usefulness of their presentations.

6. RECOMMENDATIONS and CONCLUSIONS

1. The target groups for the Workshop were hunters, administrators and scientists. The Workshop strongly emphasised the usefulness the hunters' knowledge and experience for the conclusions drawn at the meeting. The Workshop recommends that the hunters' knowledge and experience are utilised in future workshops.
2. The Workshop acknowledged the work on upgrading, maintenance and standardisation of the harpoon canons and other whale hunting equipment in Greenland in the past years, and of the continued follow-up efforts, including the establishment of a permanent control system. This work has resulted in considerable improvements in personnel safety and has also increased the efficiency in the killing of fin- and minke whales. The Workshop acknowledged the major economic costs that are associated with this work.
3. The Workshop referred to the follow-up work of the Faroe Islands with respect to shooting tests of different weapons and ammunition types on dead pilot whales. This information was very useful and can be utilised in standardising methods for similar studies on other species. The Workshop recommended that NAMMCO encourage the member countries to undertake more controlled and standardised studies on other species, and if necessary during ordinary hunting activities. The Workshop advised the NAMMCO Committee on Hunting Methods to develop guidelines for such studies and to make recommendations for target species.

4. The presentations and discussions under the Weapons and ammunitions theme indicated a great variation, between the member countries, with respect to the requirements for weapons and ammunitions used in hunting adult seals. The Workshop regarded it as beneficial to investigate the possibilities for harmonising the weapons and ammunition types for each species, with due considerations to the variations in hunting conditions in the NAMMCO member countries. In this regard it would be important to utilise the experience held by the hunters, and the Workshop urged that necessary studies be undertaken in order to support the harmonisation scientifically.
5. At the previous workshop on hunting methods in Nuuk in 1999, it was noted that the ammunition determined by experts to be the most efficient, was not always available in the stores. This remains a problem in several of the NAMMCO member countries. The Workshop repeated that it is questionable that market considerations still have higher priority than scientific and professional judgement and considerations.
6. Results from Norwegian studies on rifles used as secondary weapons in the minke whale hunt were presented at the Workshop. These results showed that full metal jacket, round nosed ammunition from calibre 9.3 mm and larger, was very efficient for killing minke whales with a shot to the brain. The Workshop recommended that when weapons are replaced this is taken into consideration.
7. The Workshop referred to the "Report of the NAMMCO Workshop on Hunting Methods, February 1999" and recommended that the recommendations from that Workshop not yet considered must be followed-up.
8. The Workshop acknowledged that the introduction of the new whale grenade has resulted in greater security for the hunters and has also increased the whale killing efficiency. The Workshop further emphasised the importance of including both the hunters' safety and the animal welfare aspects in official hunting regulations, including those pertaining to hunting methods.

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NAMMCO Workshop on "Marine Mammals: Weapons, ammunition and ballistics"
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PROGRAMME

Monday 12 November

Registration Comfort Hotel Atlantic

1800-2000: Reception at Sandefjord Whaling Museum

TUESDAY 13 NOVEMBER

Chairman: Professor Emeritus Knud Nielsen, Denmark

0900-0905: **Welcome** by DMV Jústines Olsen (Faroe Islands), Chairman of the NAMMCO Committee on Hunting Methods

0905-1000: **General ballistics. Internal and External ballistics**
Dr med vet Egil O. Øen, The Norwegian School of Veterinary Science, Department of Arctic Veterinary Medicine, Norway
Questions

1000-1015: Coffee break

1015-1200: **Terminal ballistics**
Terminal ballistics related to rifle ammunition: Egil O. Øen, Norway
Terminal ballistic - what happens inside the animal?: DVM, PhD student Siri Kristine Knudsen, The Norwegian School of Veterinary Science, Department of Arctic Veterinary Medicine Norway
Questions

1200-1300: Lunch

1300-1500: **Anatomy: Anatomical features of different animals in relation to hunting**
Jústines Olsen, veterinary, Faroe Islands, (pilot whale, killer whale white-beaked dolphine and bottlenose whale)
Siri Knudsen, Norway, (minke whale, fin whale and seals)
Egil O. Øen, Norway (sperm whale)
Ole Møller, KNAPK, Greenland (beluga and narwhale)
Questions

1500- Excursion to the museum in Tønsberg

WEDNESDAY 14 NOVEMBER

0900-1000: **Weapons and ammunition**
Test shootings with rifles and captive bolt pistol on dead pilot whales and use of bolt pistol in the pilot whale hunt: Jústines Olsen, Faroe Islands
Weapon and ammunition in the Norwegian seal hunt and minke whale hunt: Egil O. Øen, Norway

NAMMCO Workshop on "Marine Mammals: Weapons, ammunition and ballistics"
13 – 15 November 2001, Sandefjord, Norway

Weapon and ammunition in the seal and whale hunt in Greenland: Nikolai Heinrich, KNAPK, Greenland
Discussion

1000-1030: Coffee break

1030-1130: **Weapons and ammunition** continues

1130-1200: **Sights and sighting implements**
Torkil Hopmark, whaler, Norway

1200-1230: Lunch

1230-1430: Tour of the whaleboat "Southern Actor", Sandefjord Whaling Museum, host ex-whaler Bjarne Liverød

1430-1530: **Maintenance, inspections and overhaul of weapons and other hunting equipment**
Peter Siegstad, KIS- consultant, Greenland
Torkil Hopmark, Norway

1530-1600: Coffee break

1600-1700: **Maintenance of weapons and hunting equipment** continues

THURSDAY 15 NOVEMBER

0900-1030: **Safety aspects and animal welfare concerns**
Jústines Olsen, Faroe Islands
Egil O. Øen, Norway
A representative from Greenland
Discussion

1030-1100: Coffee break

1100-1230: Workshop summary and recommendations

LIST OF DOCUMENTS

- NAMMCO/2001/HMWS-1 List of Participants
- NAMMCO/2001/HMWS-2 Programme
- NAMMCO/2001/HMWS-3 List of Documents
- NAMMCO/2001/HMWS-4 Egil O. Øen: "General ballistic: Internal and External ballistics"
- NAMMCO/2001/HMWS-5 Egil O. Øen: "Terminal ballistic"
- NAMMCO/2001/HMWS-6 Siri K. Knudsen: "Terminal ballistic - what happens inside the animal?"
- NAMMCO/2001/HMWS-7 Jústines Olsen og Bergur Hanusson: " Test shootings with rifles and captive bolt pistol on dead pilot whales, and the use of bolt pistol in the pilot whale hunt."
- NAMMCO/2001/HMWS-8 Peter Siegstad: "Maintenance, inspection and overhaul of weapons and other hunting equipment."
- NAMMCO/2001/HMWS-9 Current laws and regulations related to the hunting of marine mammals in the NAMMCO countries

CURRENT LAWS AND REGULATIONS FOR MARINE MAMMAL HUNTING IN THE NAMMCO MEMBER COUNTRIES

FÆRØYENE

- Løgtingslóg nr 57 frá 5. juni 1984 um hvalaveiði
nr 54 frá 20. mai 1996 um broyting í løgtingslóg um hvalaveiði
- Kunngerð nr 19 frá 1. mars 1996 um undantak fyri friðing av hvali
nr 126 frá 23. juni 1997 um friðing av hvali
nr 46 frá 8. april 1998 um grind
nr 107 frá 21. november 1989 um góðkenning av hvalvágum, sum broytt við
kunngerð nr. 64 frá 11. mai 1992, kunngerð nr 127 frá 27. august 1992,
kunngerð nr. 141 frá 23. juni 1993 og kunngerð nr 34 frá 24. mars 1994 og
kunngerð nr. 94 frá 31. mai 2001..
nr 166 frá 27. august 1993 um fyribilis góðkenning av hvalvágum
nr 118 frá 23. oktober 1996 um fyribilis góðkenning av hvalvágum
nr 72 frá 17. mai 2000 um fyribilis góðkenning av hvalvágum
- Løgtingslóg nr. 9 frá 14 mars 1985 um vernd av dýrum, sum seinast broytt við
løgtingslóg nr. 60 frá 30. mai 1990.
- Løgtingslóg nr 43 frá 22. mai 1969 um vápni v.m., sum broytt við løgtingslóg nr 54
frá 12. mai 1980.
- Kunngerð nr. 57 frá 12. september 1969 um vápni v.m.
- Løgtingslóg nr. 128 frá 25. oktober 1988 um haruveiði.

GRØNLAND

- Landstingslov nr 12 af 29. oktober 1999 om fangst og jagt
- Bekendtgørelse nr 13 af 16. marts 2001 om betalingsjagt og -fiskeri
nr 20 af 11. maj 1994 om fangst af isbjørne i Grønland
nr 30 af 11. oktober 1995 om fangst af hvid- og narhvaler
nr 6 af 29. februar 1996 om ændring af bekendtgørelse nr. 30 af
11. oktober 1995 om fangst af hvid- og narhvaler
nr 26 af 24. oktober 1997 om ekstraordinær syn og godkendelse af
harpunkanoner
nr 7 af 26. februar 1998 om fredning og fangst af hvalros
nr 13 af 3. april 1998 om rapportering ved fangst og anskydning af store
hvaler
nr 12 af 3. april 1998 om fangst af store hvaler
nr 4 af 1. februar 2000 om erhvervsjagtbeviser
nr 5 af 1. februar 2000 om fritidsjagtbeviser
- Fangstregistreringsskema (1993)
- Landsrådsvedtægt af 31. august 1959, stadfæstet den 12. februar 1960 om fredning af spraglet
sæl

ISLAND

- Whaling Act no 26, May 3, 1949
Regulation no 163, May 30, 1973 on whaling
Regulation no 304, May 9, 1983 on amendments to Regulation No. 163 of May 30, 1973 on whaling
Regulation no 239, May 10, 1984 on amendments to Regulation no. 163 of May 30, 1973 on whaling (cf. Regulation no. 304/1983)
Agreement no 9 of 26. June 1991 between Iceland and Spain on an international observer scheme for land-based whaling stations in the North Atlantic area.

NORGE

- Lov av 16. juni 1939 om fangst av hval
Lov av 3. juni 1983 nr 40 om saltvannsfiske mv.
Lov om dyrevern av 20 desember 1974
Viltloven

Melding fra Fiskeridirektøren:

- J-45-89, 14.3.89. Forskrift om kontroll av utøvelse av selfangst
J-34-98, 27.2.98. Forskrift om endring av forskrift av 20.2 1991 om utøvelse av selfangst i Vesterisen og Østisen.
J-36-2001, 8.2.2001 Forskrift om regulering av fangst av sel i vesterisen og østisen i 2001
J-45-2001, 1.3.2001 Forskrift om adgang til å drive fangst av vågehval i 2001.
J-46-2001, 1.3.2001 Forskrift om regulering av fangst av vågehval i 2001.
J-74-2000, 31.3.2000 Forskrift om utøvelse av fangst av vågehval i 2000.
J-68-2001, 27.3.2001 Forskrift om maksimalkvoter i fangst av vågehval i 2001.
J-160-2001, 3.8.2001 Forskrift om endring av forskrift om maksimalkvoter i fangst av våghval i 2001

Instruks for inspektører under vågehvalfangsten i 2001, 4.4.2001.