

# SHOOTING TRIALS ON DEAD SEALS TO EXAMINE THE KILLING POTENTIALS OF DIFFERENT RIFLE AMMUNITIONS WHEN USED FOR SEALS

By

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## BACKGROUND

Seals are hunted with various weapons throughout the world. The most common weapons used to day are rifles with expanding ammunition of different types and different calibres. The brain or upper neck is the recommended target at seal hunting in order to kill the seals instantaneously.

The effect of different types of rifle bullets and ammunition used for marine mammals has been thoroughly discussed in several workshops arranged by North Atlantic Marine Mammal Commission (NAMMCO 1999; 2001; 2004; 2006). In 2003 the NAMMCO Council endorsed a recommendation from the NAMMCO Committee on Hunting Methods to develop guidelines for controlled and standardised trials to study the efficiency of the different types of ammunitions regularly used for the hunting of marine mammals.

A set of guidelines for such trials were drafted and later accepted by the Council after test shooting with different rifles and bullets into the brain of dead pilot whales (Olsen and Øen, 2004). These guidelines were adapted to trials on seals and used to conduct shooting trials on dead seals in Vaasa, Finland in August 2007.

## SHOOTING TRIALS

The shooting trials were set up and conducted by Stefan Pellas, Anita Storm, Bengt Sandström, Lasse Ström and Maria Haldin from Finland, Ann Salomonson and Tommy Forsström from Sweden and Egil Ole Øen from Norway. Wound canals and bullet performance were documented with photos.

### Materials and Methods

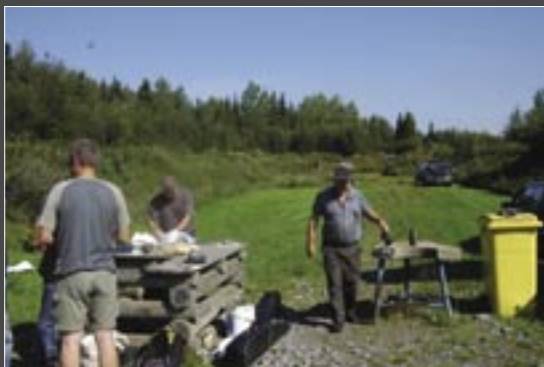
#### Target

The shooting trials were performed at Stenträskets shooting range. The temperature was 22 - 25° C. No wind.

The whole body of one and torsos from eight adult grey seals (*Halichoerus grypus*) and the whole body of one harbour seal (*Phoca vitulina*) that had died after entanglement in nets had been sampled and kept frozen until five days prior to the trials. In addition one adult grey seal that been euthanized with rifle after being entangled in nets were inspected

The shooting range had a flat tarmac area with good view of the surroundings. The seals/torsos were placed on a wooden scaffold made for these trials and shot in the head or neck from the side except for two grey seals (No 8 and 12). One was shot in the brain from the front and the other in the neck from behind. A marksman shot from a shooting bench and the shooting range was 50m.

The seals and torsos were numbered with Roman I to XIII. The size (circumference) of each head was measured using a measuring tape. Some of the largest torsos were used for one head-shot and one neck-shot (Indicated with Shot 1 and Shot 2, respectively) and for each shot a label indicating the seal's number and the number of shot was fixed to the head when photo documented.



Shooting range area



Placement of seal torso

### **Ammunition**

Four calibres commonly used for seal hunting in Finland; .222Rem, .243Win, 6,5x55 SE, and .308 Win, and two smaller calibres not allowed for seal hunting in the Nordic countries; .17HMR and .22 Win Magnum were chosen for the trials (Tab. 1). The bullets were types Soft pointed (Sako Gamehead SP), Polymer tipped Varmint (Hornady V-Max and Nosler BST) and Winchester jacketed hollow point (JHP).

Varmint bullets are intended to violently disintegrate upon impact with target. For this reason they are usually relatively light in weight and have very thin jackets. The bullet's construction is either polymer tipped or hollow pointed. The copper jacket is designed to hold the bullet together during the rotational phase and the tip acts as a "wedge" and pushes backwards into the bullet and smashes into the largest part of the core at impact. This ensures instant fragmentation even in low velocity in long range shooting situations. The bullets have high ballistic coefficients (BC) and are therefore accurate even at longer ranges. The bullets dramatic fragmentation upon impact prevents complete penetration of the body and reduces the risk of ricochet and of wounding other animals in the surroundings.

### **Inspection and autopsy**

After each shot the hitting area and the entrance and possible exit wounds were localised and inspected. The skull was inspected and palpated to check the degree of crushing of bones. A wooden probe was carefully inserted through the entrance wound and was kept in place until the autopsy had been performed and the wounds had been photo documented.

The torsoes and seals were consecutively autopsied with suitable equipment and tools, including the wooden probes, knives, bone saw etc. A cranium of a grey seal was used as a guide and for the comparison of anatomical structure.



**Head measurements**



**Localisation of wound**

The first step of the autopsy was a careful investigation with the wooden probe to check and measure the length of the wound canal. The skin and muscles were opened at the neck and the top of the head and carefully removed until the wound canal could be inspected by carefully slicing the soft tissue from the bullet's entrance to the end of the wound canal or the exit hole to demonstrate the canal in its full length including any crater formation, crushed bones and remains of projectiles. The wound canal was described in a protocol and further documented by photos.

The skull (calvarium) of one seal (No. 8) that had been shot in the mid neck was opened and the brain inspected and photo documented in its "undisturbed" state for comparison with brains that had been hit and destroyed by bullets.

## Results

The results of the trials are listed in Table 1 and Appendix 1.

*Table 1. Calibres, type of rifle bullets and autopsy findings of hits in the skull and neck of dead seals.*

<b>Calibre</b>	<b>Bullet</b>	<b>Bullet weight gr/g</b>	<b>Shot no.</b>	<b>Seal no.</b>	<b>Head size Cm</b>	<b>Target site</b>	<b>Autopsy findings</b>
.17HMR	V Max	17/1.2	I	1	45.8	Head	Skull crushed. No exit
.17HMR	V Max	17/1.2	II	1	45.8	Neck	C <sub>1</sub> crushed. No exit
.22 Win Mag	Jacketed HP	40/2.6	XI	9	34.0	Head	Skull crushed. Exit
.22 Win Mag	Jacketed HP	40/2.6	XII	9	34.0	Neck	C <sub>6</sub> crushed. Exit
.222Rem	Gamehead SP	50/3.2	III	2	45.0	Head	Skull crushed. No exit
.222Rem	Gamehead SP	50/3.2	VIII	7	67.5	Head	Hit in front of head. Skull crushed. No exit
.222Rem	Gamehead SP	50/3.2	IX	7	67.5	Neck	C <sub>3</sub> crushed. No exit
.222Rem	Gamehead SP	50/3.2	X	8	45.5	Neck	C <sub>3</sub> crushed. No exit
.243Win	Gamehead SP	90/5.8	IV	3	47.0	Head	Skull crushed. Exit
6,5x55SE	BST	120/7.8	V	4	45.0	Head	Skull crushed. Exit
.308	V-Max	110/7.1	VI	5	52.5	Head	Most of skull crushed. No exit
.308	V-Max	110/7.1	XIII	12	57.0	Neck	C <sub>1</sub> in the neck crushed Most of skull crushed. No exit
.308	Gamehead SP	123/8.0	VII	6	45	Head	Most of skull crushed. No exit

**Calibre:** .17HMR  
**Ammunition:** 17gr/1.2g Hornady V-Max,  $V_0 = 2250\text{f/s} - 777\text{m/s}$   
**Rifle:** Sako Quad Hunter with 560mm Varmint barrel  
**No. of rounds:** 2  
**Shooting range:** 50m  
**Hitting points:** Head and neck

*Shot I: Torso no. 1: Adult grey seal. Head size: 45.8cm.*  
 Skull.

Entrance wound 2cm behind and under left eye (mid between eye and ear).  
 The bullet went into the skull. No exit.

**Autopsy:** Wound canal: Ca. 12-15cm.

Crushed bones could be detected by palpation at entrance wound. The skull bones were crushed up to 4cm from entrance wound. Small fragment of jacket found inside the skull. Brain completely destroyed.

*Shot II: Torso no. 1: Adult grey seal. Head size: 45.8cm.*  
 Neck. Left side.

Entrance wound in neck 3cm behind the skull. No exit.

**Autopsy:** Wound canal: Ca. 12-15cm.

The bullet hit  $C_1$  and crushed the cervical bone into small pieces. The bullet or the impact from the strike in the bone had crushed the rear part (*Os occipitale*) of the skull and almost transected the head from the cervical portion of the vertebral column. Also base of skull had cracked in front of *Foramen magnum*.



**Calibre:** .22 Win Magnum  
**Ammunition:** 40gr/3g Winchester super X Jacket hollow point,  
 $V_0 = 1910\text{f/s} - 582\text{m/s}$   
**Rifle:** Savage mod. 93SS with 530mm barrel  
**No. of rounds:** 2  
**Shooting range:** 50m  
**Hitting points:** Head and neck

*Shot XI: Harbour seal, young, No. 9. Head size: 34cm.*

Skull. Left side.

Entrance wound 2cm behind eye.

The bullet went completely through the head. Exit wound diameter ca. 3cm.

**Autopsy:** Wound canal: 15cm.

The violently crushed skull could easily be detected by palpation.

Brain completely destroyed.

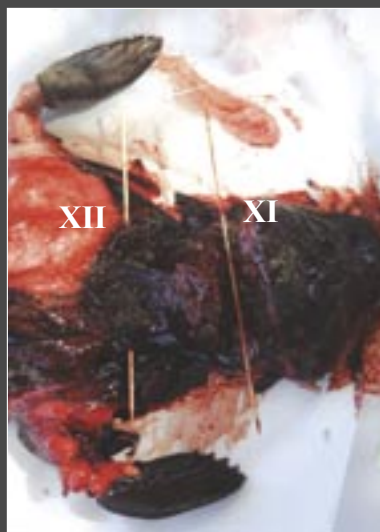
*Shot XII: Harbour seal, young, No. 9. Head size: 34cm.*

Neck. Left side.

Entrance wound in neck about 10cm behind the skull. Exit wound detected on opposite side.

**Autopsy:** Wound canal: Ca. 10cm.

The bullet hit  $C_6$  and crushed the cervical bone into small pieces.



**Calibre .22 Win Magnum**  
**Two shots: XI, XII**  
**Torso no. 9**

**Calibre:** .222Rem  
Ammunition: 50gr/3.2g Gamehead SP,  $V_0 = 3198\text{f/s} - 975\text{m/s}$   
Rifle: Sako Vixen Mannlicher with 500mm barrel  
No. of rounds: 4  
Shooting range: 50m  
Hitting points: Head and neck

*Shot III: Torso no. 2. Adult grey seal. Head size: 45cm.*

Skull. Left side.

Entrance wound close to left ear. No exit.

**Autopsy:** Wound canal: Ca. 15cm.

The crushing of the skull could easily be detected by palpation. It was also visible as the roof of the skull had fallen down.

Both eyes were popping out of the skull.

Brain completely destroyed.

Bullet fragments were found under skin on the right side of the head.

*Shot VIII: Torso no. 7. Large grey seal, male. Head size: 67.5cm.*

Skull, frontal.

Blubber thickness in the neck: 7cm.

Entrance wound over the right eye. No exit.

**Autopsy:** Wound canal: Ca. 30cm.

The bullet was fired from the front and hit the right side of the skull. A marked depression was visible on the right side as the skull roof had fallen down. Crushed skull bones were palpated through the thick layer of speck.

Brain completely destroyed.

The bullet had passed through and splintered *Os occipitale* and jacket and fragments of the core were found in  $C_1$ .

*Shot IX: Torso no. 7. Large grey seal, male. Head size: 67.5cm.*

Neck. Left side.

Entrance wound in neck at  $C_3$ , about 8cm behind the skull. No exit.

**Autopsy:** Wound canal: Ca. 20cm.

The bullet hit  $C_3$  and crushed the bone. The bullet jacket and some of the core were detected inside the spinal canal.

The tissue at vertebral column and the bones were still frozen.

*Shot X: Torso no. 8. Adult grey seal. Head size: 45.5cm.*

Neck. Left side.

Entrance wound in neck at  $C_3$ , about 5cm behind the skull. No exit.

**Autopsy:** Wound canal: Ca. 10cm.

The bullet hit  $C_3$  and crushed the bone. The bullet jacket and some of the core were found at the bone fragments.

This seal was not used for “head shooting”. The calvarium was removed and a photo was taken to demonstrate an “unwounded” brain for comparison.

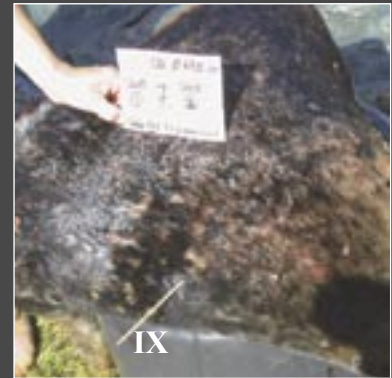


Calibre .222 Rem  
Four shots:

III, torso no 2



VIII, IX, torso no. 7



X, torso no. 8

Unwounded brain

**Calibre:** .243 Win  
**Ammunition:** 90gr/5.8g, Sako Gamehead SP,  $V_0 = 3133\text{f/s} - 955\text{m/s}$   
**Rifle:** Sako 75 SS with 570 mm. barrel  
**No. of rounds:** 1  
**Shooting range:** 50m  
**Hitting points:** Head

*Shot IV: Torso no. 3. Adult grey seal. Head size: 47cm.*

Skull. Left side.

Entrance wound 2cm behind ear. Exit wound about 2.5cm on right side of head.

**Autopsy:** Wound canal: Ca. 15cm.

Skull roof and skull base crushed. This could easily be detected at palpation.

Brain completely destroyed.

**Calibre:** 6,5x55 SE  
**Ammunition:** 120gr/7.8g, Nosler BST,  $V_0 = 2821\text{f/s} - 860\text{m/s}$   
**Rifle:** Blaser R93 Professional with 570mm barrel  
**No. of rounds:** 1  
**Shooting range:** 50m  
**Hitting points:** Head

*Shot V: Torso no. 4. Adult grey seal. Head size: 45cm.*

Skull. Left side.

Entrance wound 2cm behind and 2cm under left ear.

Exit wound about 1cm on right side of head.

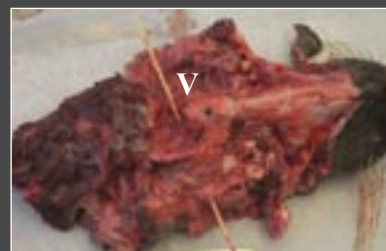
**Autopsy:** Wound canal: Ca. 15cm.

Most of skull, both roof and base of cranium crushed. This could easily be detected at palpation.

Brain completely destroyed.



Calibre .243 Win  
 One shot, IV  
 Torso no. 3



Calibre 6,5x55 SE  
 One shot, V  
 Torso no. 4

**Calibre:** .308 Win  
**Ammunition:** 110gr/7.2g, Hornady V-Max,  $V_0 = 3180\text{f/s} - 970\text{m/s}$   
 Hand loaded by S. Pellas  
**Rifle:** Sako 75 SS with 570mm barrel  
**No. of rounds:** 2  
**Shooting range:** 50m  
**Hitting points:** Head

*Shot VI: Torso no. 5. Adult grey seal. Head size: 52.5cm.*

Skull. Left side.

Entrance wound 2cm behind and 2cm under left ear. No exit.

**Autopsy:** Wound canal: Ca. 20cm.

The skull was completely destroyed and fell apart into pieces when the skin had been removed.

Eyes were popping out of the skull.

Nothing left of the brain tissue.

Small fragments of jacket found in the “wound crater”.

*Shot XIII: Seal no. 12. Adult grey seal. Head size: 57cm.*

Neck. From behind.

Entrance wound in the midline of the neck 15cm behind the head.

**Autopsy:** Wound canal: Ca. 20cm.

The bullet went through the skin and muscles and hit the vertebral column at  $C_1$ .

It went into the skull and crushed the skull bones. Only fragments of skull bones were left and the head had been transected from the vertebral column and the skull fell apart when the skin had been removed.

No fragments of bullet were retrieved.

**Calibre .308 Win**  
**Two shots:**

**VI**  
**Torso no. 5**



**XIII**  
**Torso no. 12**



**Calibre:** .308 Win  
**Ammunition:** 123gr/8.0g, Sako Gamehead SP,  $V_0 = 3030\text{f/s} - 925\text{m/s}$   
**Rifle:** Sako 75 SS with 570mm barrel  
**No. of rounds:** 1  
**Shooting range:** 50m  
**Hitting points:** Head

*Shot VII: Torso no. 6. Adult grey seal. Head size: 45cm.*

Skull. Left side.

Entrance wound 5cm behind and 2cm under left ear. Exit wound 2cm.

**Autopsy:** Wound canal: Ca. 15cm.

The skull was crushed. Almost transected and it fell apart when the skin had been removed.

Eyes were popping out of the skull.

This could easily be detected at palpation.

Brain completely destroyed.

## Addendum

**Calibre:** 7X57 R  
**Ammunition:** 150gr/9.7g, Norma SP,  $V_0 = 2690\text{f/s} - 820\text{m/s}$  (2 mtrs, two shots)  
**Rifle:**  
**No. of rounds:** 2  
**Shooting range:** Ca. 2m  
**Hitting points:** Head

This was an adult grey seal entangled in nets that had been euthanized with two shots fired at the head at close range from behind.

**Autopsy:** The skull had been hit from behind and was crushed completely. The brain was completely destroyed. The skull was filled with blood and the brain was destroyed.

Calibre .308 Win  
 One shot, VII  
 Torso no. 6



## CONCLUSIONS

The results from the test shooting on torsos and carcasses of dead grey and harbour seals with the rifle calibres .17, .22, .222, .243, 6.5x55 and .308 with corresponding ammunition and bullets weighing from 17gr/1.2g to 123gr/8.0g penetrated into and crushed the skull bones and destroyed the brain at a shooting range of 50m. The bullets also penetrated into the neck and crushed the cervical bones of seals of both species.

The results strongly indicate that all the bullets tested in this trial had capacity to kill seals of the size of an adult grey seal (150-200kg) instantaneously or very rapidly when hitting the brain area of the skull or the cervical bones in the upper neck at a shooting distance of 50m. The violent crushing of the bones at this shooting range indicates that the effect probably will be the same also at some longer ranges.

The most striking end effect was seen after hits with the very light .17 Hornady V-Max Varmint bullet (17gr/1.2g,  $V_0 = 2250\text{f/s} - 777\text{m/s}$ ) which fractured and penetrated the skull and had “blew up” the brain. It also cracked and destroyed the cervical bones of the neck.

The trials also showed that shooting projectiles into skulls of dead seals is a valid method to assess ammunition used for seal hunting and its ability to penetrate into and destroy the function of the brain and central nervous system and thereby causing rapid death of the animal.

Torsos and carcasses of grey and harbour seals were used for the present study because of its accessibility. However, the results would probably be similar on other species of approx. same size and some of the bullets used will also be effective on much larger seal species.

The trials were conducted under almost ideal conditions with no wind. The lightest of the bullets will be most sensitive to wind and might not be recommended used in hunting situation with bad weather (wind, rain, snow) despite their dramatic effect on sensitive organs like the brain before they are tested also in less favourable weather conditions.

In some Nordic countries the regulations for ammunition used for seal hunting are mainly focusing on calibre, bullet weight and impact energy and relatively high calibres with relatively heavy and expanding bullets used for the hunting of terrestrial games are required even for smaller species of seals. Too strong conclusions should not be drawn from the limited number of tests of the respective calibres and bullets used in this trial. However, it shows with clarity that the construction and quality of the bullet might be just as important for the bullets' performance to kill as its calibre.