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## Background

The guidelines for monitoring blubber thickness in seals has been created. Please note that this document describes how the evaluation/GES has been done/set up until now – this indicator needs further development.

## Action requested

The Meeting is invited to consider/provide input for the Meeting



# Guideline for monitoring blubber thickness of seals in the HELCOM area

## 1. Background

### 1.1 Introduction

Blubber thickness responds to short-term variations in the environment and an indicator that complements the population trend and pregnancy rate indicators. Blubber acts as isolation to maintain body temperature and energy storage in seals and therefore an unnatural reduction in blubber affects reproduction and survival of seals and may act as an early warning of decline in population trends.

A natural seasonal difference in blubber thickness with a decrease during the reproduction, lactating and molting periods in spring and an increasing blubber thickness towards autumn has been described for adult grey seals (Sparling et al., 2006). Thus, blubber thickness varies with region, age, reproductive status and time of year. Blubber thickness affects somatic growth, age at sexual maturity, fecundity, implantation of embryos, maintenance of pregnancy, age specific mortality as well as vulnerability to parasites and diseases. Several studies have shown that seals with lower body weight and lower fat reserves show increased mortality (Kjellqwist et al. 1995, Harding et al. 2005, Bowen et al 2015) and decreased reproductive rate (e.g. Boyd et al. 1999). Unnatural decrease in blubber thickness can occur along e.g. chronic diseases, starvation (e.g. decreasing fish stocks or fish quality). In addition, climate change could potentially affect blubber thickness. Body condition (blubber thickness) of pups may have delayed effects on body size and reproductive rate when these individuals are adults (Kauhala & Kurkilahti 2020).

The sternum blubber thickness, the most widely used measuring site of blubber thickness in dead pinnipeds, was found to correlate strongly with percent fat in all three Baltic seal species, which indicates that it is a good indicator of total blubber content (Hermansson 2015).

## 1.2 Purpose and aims

Functional indicators require continued and synchronized monitoring among countries in the region. The aim of this document is to define practices and methodology to monitor the blubber thickness in seals for the HELCOM indicator.

## 2. Monitoring methods

### 2.1 Monitoring features

There are three regularly occurring seal species in the HELCOM area (i.e. the Baltic Sea and Kattegat): harbour seal, ringed seal and grey seal.

### 2.2 Time and area

Grey seals occur in the entire Baltic Sea, but in the Kattegat the species is rare. The status of the grey seal in the Baltic Proper is evaluated as a single unit, whereas the status of the Kattegat grey seal population should be evaluated separately.

Ringed seals occur in the Bothnian Bay (which is one management unit), and the Gulf of Finland, Archipelago Sea, Gulf of Riga and Estonian coastal waters (which is a second management unit). The status of ringed seals should be evaluated individually for these two management units.

Harbour seals are confined to the Kalmarsund in the southern Baltic Sea, the southwestern Baltic, the Kattegat, and the Limfjord, all of which are separate management units.

### 2.3 Monitoring procedure

#### 2.3.1 Monitoring strategy

By-caught, stranded and shot seals are included in the assessment. For all animals, background information on age, sex, reproduction status and health need to be collected. Based on pathological or clinical examinations, any factor that could influence blubber thickness and the nutritional status in general should be identified, e.g. infectious diseases, degenerations, malformations, poor dentition or tumors.

Pathological investigations should include necropsies, histology and immuno-histochemistry. Body decomposition must be recorded as well as the estimated time of death. The age and reproductive status and should be determined.

Clinical examinations includes blood status and chemistry, serology and cytology. The weight (if possible) and length of the animal should be recorded, and the age and reproductive status estimated.

Pathology and clinical examination should further include parasitology, microbiology, virology, and toxicology.

*Data to be collected from all three seal species:*

1. Blubber thickness at the distal part of the sternum in dead animals with a millimeter measure. Care should be taken not to include the skin or underlying tissues.
2. Clinical or morphological pathologies need to be examined according to the above mentioned methods
3. Age of the animal is estimated based on the length, sex and weight in live animals and determined based on teeth cementum analysis by counting the annual growth layers in dead seals (Johnston & Watt 1980, Lockyer et al. 2011).

### 2.3.2 Sampling method(s) and equipment

In dead animals, blubber thickness is measured by making an approximately 5-7 cm long cut on the ventral side of the thorax and at the middle of the sternum length. Blubber thickness is measured in millimeters and care is taken not to include the skin or underlying tissues.

In live animals, the dorsal blubber thickness is measured with ultrasound in live animals (in millimeters). Correction factors for different locations needs to be developed. For example, Hermansson (2015) found that dorsal and sternum blubber thicknesses correlated with each other, the dorsal measure (corresponding to the ventral measurement along the length of the animal) being on average 11.4 % thicker.

Currently, a uniform necropsy protocol is not used, but would be sensible to develop in order to harmonize the data collection in the HELCOM area.

## 2.4 Data analysis

### 2.4.1. Assessment

Currently, only average blubber thickness from hunted 1-3 year old grey seals of both sexes, shot during autumn, are assessed as a trend and in relation to the good environmental status threshold. This will be extended to different origins (by-caught and stranded animals) and different age classes based on data collected all over the HELCOM area for the different species.

### 2.4.2. Good environmental status

The concept for defining a GES threshold for nutritional status of seals is derived from the general management principle in the HELCOM Recommendation 27/28-2, which states that the population size is to be managed with the long-term objective of allowing seal populations to recover towards carrying capacity levels. The recommendation further states that the long term goal is to reach a status that ensures the future persistence of marine mammals in the Baltic.

Currently, good environmental status (GES) for grey seal is achieved when blubber thickness of sub-adults is at least 40 mm (for hunted seals), 35 mm (for by-caught seals) or a proposed threshold of 25 mm if the population is assessed to be at carrying capacity (Table 1). More work is needed to decide on a new GES when data from all over the HELCOM area is used.

To set the threshold value for grey seals, data on blubber thickness during the period 2001-2004 represents the most recent data period that indicated good status and was used to form a modern baseline for the threshold value concept for populations undergoing exponential growth (after 2005 the trend for blubber thickness has been decreasing). This approach is aligned with procedure used in OSPAR (Commission for the Protection of the Marine Environment of the North-East Atlantic), where baseline levels are set at pristine conditions 'where influence of human impact is minimal', or alternatively, a 'modern baseline when the former isn't applicable'.

Threshold values are defined for two scenarios: for populations under exponential growth and for populations at carrying capacity. A provisional threshold value of 25 mm is currently proposed if the population is assessed to be at carrying capacity. These values are used for grey seal. GES for harbour and ringed seals is yet to be defined.

Table 1. Threshold values according to HELCOM HOD 48-2015, outcome para 3.63, Annex 4

Nutritional status of marine mammals	Samples from	Populations at		Agreed on GES Agreed to publish DE: study reservation on the indicator concept and GES]
		exponential growth	carrying capacity	
	Hunted seals	40 mm blubber	25 mm blubber	
	By-caught seals	35 mm blubber	25 mm blubber	

### 3. Data reporting and storage

Raw data and metadata should be stored in national databases and reported upon for calculation and comparison with GES.

### 4. Quality control

#### 4.1 Quality control of methods

Extensive knowledge of the clinical and morphological pathologies of seals is essential in order to produce high-quality data. The measurement of blubber thickness can be done after instruction by for example hunters, but the accompanying evaluation of the health of the animals should be done by specialist veterinarians and pathologists or highly specialized biologists. A comparison between blubber thickness measured by hunters and pathologists showed no significant difference (Bäcklin et al. 2011).

## 4.2 Quality control of data and reporting

As a quality control measure, each of the responsible organizations must check the gathered data for errors before reporting.

## 5. Contacts and references

### Responsible organizations:

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## 5.2 References

- Bowen, W. D., den Heyer, C. E., McMillan, J. I., & Iverson, S. J. 2015. Offspring size at weaning affects survival to recruitment and reproductive performance of primiparous gray seals. *Ecology and evolution*, 5(7), 1412-1424.
- Boyd, I. L., Lockyer C., Marsh H. D. 1999 Reproduction in marine mammals. In: *Biology of marine mammal*, Ed. Reynolds J.E.. Smithsonian p. 218-286
- Bäcklin, B-M., Moraesus, C., Roos, A., Eklöf, E., and Lind, Y. 2011. Health and age and sex distributions of Baltic grey seals (*Halichoerus grypus*) collected from bycatch and hunt in the Gulf of Bothnia. *ICES Journal of Marine Science*, 68: 183–188.
- Harding, K. C., Fujiwara, M., Axberg, Y., & Härkönen, T. 2005. Mass-dependent energetics and survival in harbour seal pups. *Functional Ecology*, 19(1), 129-135.
- Hermansson, A. 2015. Blubber thickness variation in grey, harbour and ringed seals. Master thesis. University of Gothenburg, Gothenburg, Sweden
- Johnston, D.H. & Watt, I.D 1980. A rapid method for sectioning undecalcified carnivore teeth for aging. 1st Worldwide Furbearer Conference Proceedings, August 3-11, 1980, Frostburg, Maryland, USA, Vol. 1, pp 407- 422.
- Kauhala, K., Bergenius, M., Isomursu, M. et al. 2019. Reproductive rate and nutritional status of Baltic ringed seals. *Mammal Research* 64, 109–120. <https://doi.org/10.1007/s13364-018-0381-1>
- Kauhala, K. & Kurkilahti, M. 2020. Delayed effects of prey fish quality and winter temperature during the birth year on adult size and reproductive rate of Baltic grey seals. *Mammal Research* 65: 117-126.
- Kjellqwist, S. A., Haug, T., & Øritsland, T. 1995. Trends in age-composition, growth and reproductive parameters of Barents Sea harp seals, *Phoca groenlandica*. *ICES Journal of Marine Science*, 52(2), 197-208.
- Lockyer, C., Mackay, B., Härkönen, T., Read, F. and Hasselmeier, I. 2011. Age Determination in Harbour Seals. *NAMMCO Sci. Publ.* 8: 245-264
- Sparling, C. E., Speakman, J. R., & Fedak, M. A. 2006. Seasonal variation in the metabolic rate and body composition of female grey seals: fat conservation prior to high-cost reproduction in a capital breeder?. *Journal of Comparative Physiology B*, 176(6), 505-512.