

# MANAGEMENT AND STATUS OF HARBOUR SEAL POPULATION IN ICELAND 2016:

CATCHES, POPULATION ASSESSMENTS AND  
CURRENT KNOWLEDGE

Sandra M. Granquist & Erlingur Hauksson



June 2016



## Veiðimálastofnun

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Cover photo: Harbour seal.

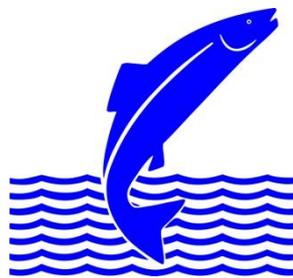
Photo: The Icelandic Seal Center

# MANAGEMENT AND STATUS OF THE ICELANDIC HARBOUR SEAL POPULATION:

## CATCHES, POPULATION ASSESSMENTS AND CURRENT KNOWLEDGE

Sandra M. Granquist<sup>1,2</sup> & Erlingur Hauksson<sup>3</sup>

- 1) Institute of Freshwater Fisheries, Brekkugata 2, Hvammstangi, Iceland.
- 2) The Icelandic Seal Center, Brekkugata 2, Hvammstangi, Iceland. E-mail: rannsoknir@selasetur.is
- 3) Vör Marine Research Center at Breiðafjörður, Norðurtangi 3, 355 Ólafsvík.



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## ABSTRACT

This report includes a review of current management of harbour seals in Iceland. Trends in harbour seal abundance and previous and current harbour seal catch statistics are presented. The Icelandic seal hunting legislation and management objective is discussed, as well as knowledge on harbour seal population identity.

## ÁGRIP

Íslensk titill: *Stjórnun og ástand íslenska landselsstofnsins 2016: Selveiði og stofnstærðarmat*

Skýrslan inniheldur samantekt um stjórnun landselsstofnsins við Íslands strendur. Fjallað er um stofnstærðarsveiflum, beinar veiðar og landselir sem meðafla. Löggjöf um veiði á landsel og stjórnunarmarkmið stjórnvalda á landselastofnin er rædd og gefið yfirlit yfir þekkingu á samsetningu landselsstofns.

# 1. INTRODUCTION

Seal hunting used to be an important resource for Icelandic farmers for centuries and between 1962 and 1975 the annual catch was between 4.500 and 6.000 animals. However, the global anti-sealing campaign in the seventies led to a collapse in prizes of seal skin and furthermore, the utilization of seal meat became less important for human consumption. Hence, the sealing decreased significantly. Between 1982 and 1989 a bounty system for harbour seals, funded by the Research Committee for Biological Seafood Quality (RCBSQ), was used and catches increased temporarily. Between 1990 and 1995 RCBSQ and the Seal Farmers Union (SFU) cooperated by combining traditional harbour seal pup-hunting and utilization of skins from the hunted seals. A prize was paid for each skin of caught pup. Since then no bounty system has been in use. For the last 20 years harbour seal catches have been relatively small. Members of the SFU, traditionally hunting harbour seals to utilize the meat or skin, are nowadays few. However recently, harbour seals are mainly hunted around estuaries to decrease suspected seal predation on migrating salmonids. Due to indications of severe decrease in the Icelandic harbour seal population (Granquist et al. 2015), an investigation of current harbour seal management, catch statistics and population assessments has been made and will be presented in this report.

# 2. POPULATION ASSESSMENTS AND TRENDS

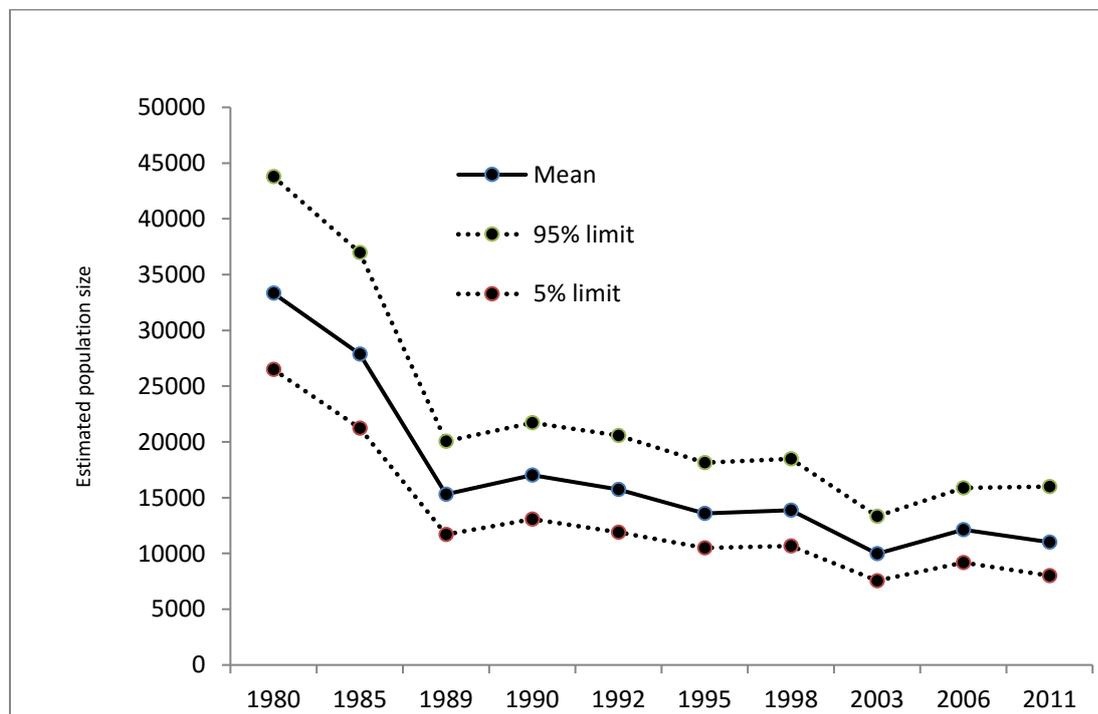
The first complete harbour seal census, where the whole shore line of Iceland was taken into account, was conducted in 1980 and been repeated ten times since then. The census was always conducted during the moulting period which occurs in August and in the first nine censuses, the whole coastline was surveyed at least once. In the census of 2011 the method was up-dated in accordance to Teilman et al. (2010) and the whole coastline of Iceland was covered 3-4 times (Granquist et al. 2011). The mean number of observed seals in 2011 was 4.983, which was not significantly different from the two previous counts in 2003 (4411 observed individuals) and 2006 (5.367 observed individuals) (Figure 2). Based on calculations using the number of observed individuals, the population was estimated to be between 11.000 and 12.000 animals in 2011 (Figure 1).

A complete census has not been conducted since 2011, due to lack of funding. However, a partial census was carried out in 2014, where areas with high harbour seal density were included (i.e. Northwest, West and Southwest parts of Iceland). The results showed that on average, the annual decrease was 28.55% ( $r_{est} (SD) = -0.3362 (0.0237); 1 - \exp(r_{est}) \times 100$ ) in the areas included in the census. If this decrease is extrapolated to the whole country, this would mean that the seal population decreased by half in a two year period. Although there are too many unknown variables to build a statement on if the decrease is applicable to rest of the country (Granquist et al. 2015) the areas that were surveyed in 2014 probably give a good indication of the status of the whole population, because during the complete census in 2011, 62.0% (SD = 5.07%) of all the seals were observed in these areas. Given that the decrease found in 2014 only applies to the counted areas and that the population was stable in other areas, the whole population would have decreased from ~11.500 to ~8.000 animals between 2011 and 2014. Calculations show that if the Icelandic harbour seal population is expected to be 8.000 individuals, the cumulative probability of the population

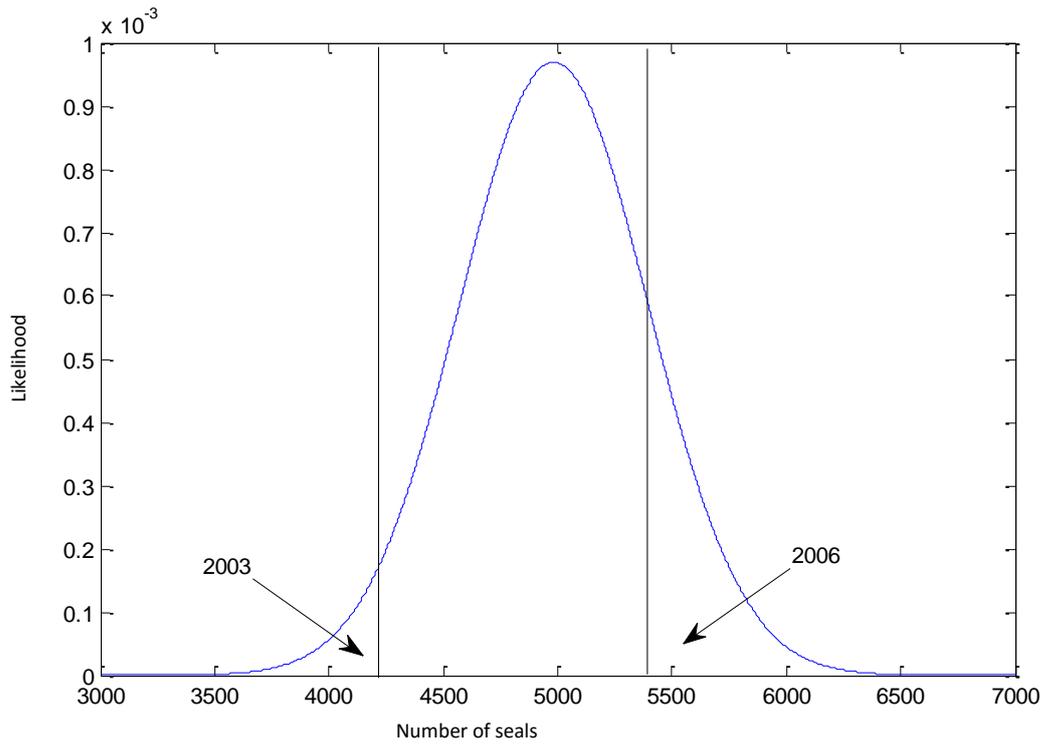
becoming quasi-extinct (< 500 animals) is very small for the next 10 years if based on methods described in Mills (2007) and count based PVA (density independent model) from Morris and Doak (2002), Figure 3).

There is a large uncertainty regarding reasons behind the possible decline and further research regarding this is necessary. Sealing has probably played an important role in the decrease of the harbour seal population, but it is uncertain how much due to limited documentation of numbers of seals caught in direct catches and by-catches. The reported figures of seal removals can be considered as a minimum number (see section 3.1). To be able to understand the dynamics of the harbour seal population in Iceland we urgently need more information on their distributional pattern and stock identity.

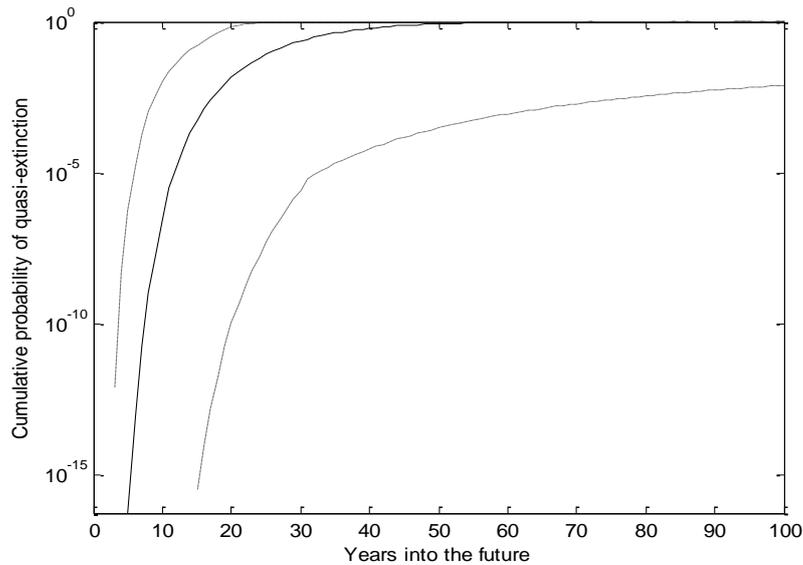
Shifts in prey availability might partly explain the decline in the seal population. Harbour seal dietary data from Osar, a haul-out site in NW Iceland, shows that the proportion of seal diet consisting of *Ammodytidae* was similar in 2009–2011 compared to previous years when the sand eel population was large (Granquist and Hauksson 2016b). Nevertheless, when investigating a wider geographic area, Hauksson et al. (2016) found that sand eels were much rarer in the diet of harbour seals in 2007–2010 than in 1992–1993 (Hauksson et al. 2016), and there were signs for worse condition of juvenile harbour seals in the period 2007–2010 than in earlier periods of 1979–1983 and 1990–2000 (Hauksson and Olafsson 2016).



**Figure 1:** Estimated population sizes from aerial surveys of Icelandic harbour seals. Solid lines with blue dots show the mean, a dotted line with green circles shows the upper limit of the confidence limit (95%) and a dotted line with red circle shows the lower CI (5%).



**Figure 2:** Normal distribution of 5000 values with the mean number of observed seals = 4.983 and standard deviation = 412, in 2011. The vertical lines show the number of observed individuals in 2003 (4.411 seals) and 2006 (5.367 seals). Results published in Granquist et al. (2011).



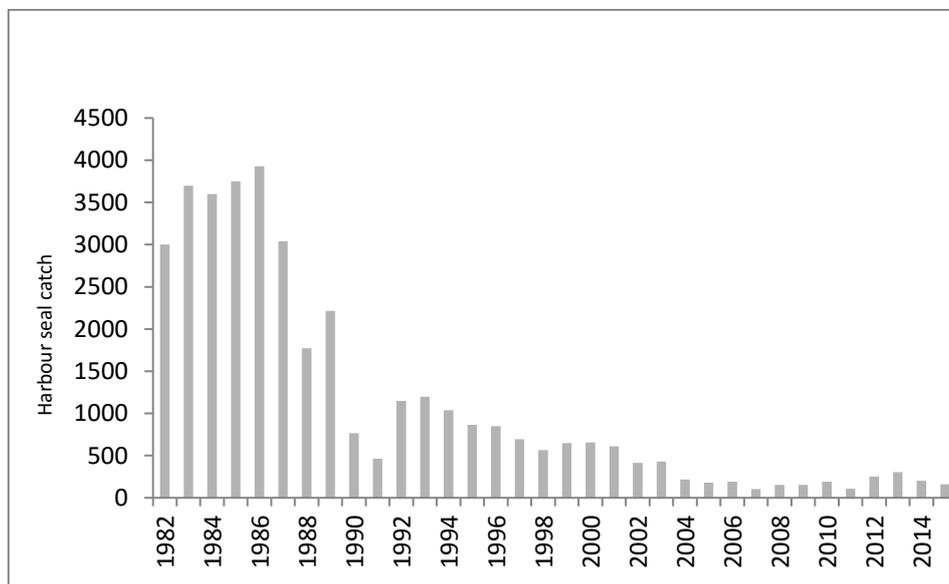
**Figure 3.** Cumulative probability of the Icelandic harbour seal population if set to 8.000 animals (black line) having a quasi-extinction (becoming 500 animals). The dotted lines delineate an approximate 95% confidence interval determined by a bootstrap.

### 3. CATCH STATISTICS OF HARBOUR SEALS AND REGULATORY MEASURES

#### 3.1 Current hunting management

Seal hunting in Iceland does not require a specific hunting license, only a license to own and handle a weapon. No specific quota system has been established for seal hunting in Iceland. Furthermore, there are no fully protected areas for seals, meaning that harbour seals can be hunted almost everywhere with landowners permission. Hunting is allowed the whole year round and there is no legal requirement on catches being reported. Members of the SFU can voluntarily report their catch statistics to SFU. However, seals caught to prevent predation on salmonids near salmon rivers are normally not reported to SFU. Therefore, the estimated number of caught seals in Iceland has been based on catches reported to SFU along with numbers obtained from other known seal hunters that have been contacted. The numbers reported by SFU has been decreasing for the last few years, while the numbers received from other hunters, mainly from those hunting at estuaries has been growing during the same period. In 2015, 159 harbour seals were caught by direct hunting by eight hunters in total. Of these seals, 82% were caught in the vicinity of estuaries, where salmon rod fishing is conducted. The hunt in estuary areas was either carried out on behalf of local angling associations or by landowners. Since reporting catches is currently not mandatory, it is likely that not all hunters are included in the present catch statistics, which causes a bias in the catch statistics. Therefore, there is a clear need to improve the current catch reporting system (Figure 4).

Contradictory to the direct harbour seal catches, seals caught as by-catch in fishing gear should be reported to the authorities according to Icelandic legislations. The Marine and Freshwater Research Institute (MFRI) is systematically collecting by-catch information for all marine mammals (Figure 4). However, Ólafsdóttir (2010) found out that a large proportion of by-caught marine mammals were not reported to MFRI and therefore, numbers that have been reported are not reliable to use as a measurement on total by-catches. Pálsson et al. (2015) found that harbour seals were the most common by-caught marine mammal during lumpsucker fisheries (40.6% of the reported by-caught marine mammals). Furthermore, harbour seals are the second most common marine mammal (21.0%) to be by-caught in cod fishery. Due to insufficient reporting it is hard to estimate the total number of by-caught animals, but by adding a correction factor to the reported number, Pálsson et al. (2015) estimated that in 2013, the total number (cod + lumpsucker fishery) of by-caught harbour seals was 705 individuals.



**Figure 4:** Catch statistic for the Icelandic harbour seal population 1982-2015. Numbers for the years 1982-2012 include direct catches and reported by-catches (Marine Research Institute 2014) and numbers from 2013 and 2014 include only direct catches reported to the Icelandic Seal Center.

### 3.2 Management for the Icelandic harbour seal population.

In 2006, the Icelandic government published a management objective for the Icelandic harbour seal population, where it was recommended that the population should be kept at a minimum number of 12.000 individuals (NAMMCO annual report, 2006). According to the management objective, regulation should be initiated if the population dropped below 12.000, but no specific population regulating method was mentioned.

The potential maximal growth of the Icelandic harbour seal population has not been investigated. However, numbers from Norway suggest a maximum annual growth of the harbour seal population to be around 8%, meaning that if all factors affecting the population (environmental factors etc.) status are optimal, human catch (direct catches + by-catches) should not exceed 8% to keep the

population in the current size (Bjorge and Oien 1999). In the latest complete population count for harbour seals in Iceland, the population size was estimated to be ~11.500 animals and following Bjorge and Oien (1999) the sustainable number of culling and by-catches of 8% would correspond to 920 animals. This means that, as an example the estimated total catch in the year 2013 of 1011 animals (estimated by-catch= 705 animals and reported direct catch= 306 animals) was probably not sustainable, but led to a decrease in the population. Since the partial harbour seal census carried out in 2014 suggested a large decrease in the harbour seal population (Granquist et al. 2015), caution should be taken regarding catches above the sustainability level to prevent further decrease, following the governmental management objective from 2016.

#### 4. CURRENT KNOWLEDGE ON BIOLOGICAL PARAMETERS AND STOCK IDENTITY

Knowledge regarding the stock identity of the Icelandic harbour seal population is rather scarce, but further research on pup production, population structure and annual changes in spatial distribution is planned.

An investigation on age at catch for harbour seals caught between 1982 and 2006 showed that adults were more numerous among caught individuals in 1982 than in 1992 (Hauksson 2011). However, since 1992 the purpose of the hunting has changed. In 1992 the main reason for hunting was to utilize meat and skin, mainly from pups, while during more recent times most animals were caught around river mouths. This may have shifted the age distribution of caught animals towards older animals. A mandatory recording system would enable scientists to obtain information regarding the animals that are removed from the population. Harbour seals collected from seal-hunters and fisherman in 2007 – 2010 (n=87; 50 females, 34 males and 3 animals of unknown sex), off the NW-coast of Iceland were mostly pups and juveniles (Appendix 1).

A study on haul-out pattern of harbour seals in Iceland has confirmed that the timing of previous surveys during the moulting period has been fairly correct. The distribution of seals showed a bimodal pattern, with the first peak occurring in late May/early June and the second peak occurring in late July/early August, corresponding to pupping and moulting period respectively (Granquist and Hauksson 2016b). According to the results of Granquist and Hauksson (2016b), the population should preferably be surveyed during a period of approx. three weeks, starting in the end of July. A challenge with the Icelandic census is however that a fairly large coastline has to be covered in a short amount of time, which has been proven to be hard due to weather conditions and poor visibility and hence few possible flying days. This has in some cases resulted in prolonged survey time, which could reduce the significance of the results. Granquist and Hauksson (2016b) found that factors affecting the haul-out probability were air temperature, tide height and wind-direction, which of only the tide height has been possible to take in to consideration in previous censuses.

Knowledge regarding changes in inter- and intra-annual distribution of harbour seals along the Icelandic coast is scarce, and increased knowledge regarding these factors is essential if partial counts, where only parts of the coast line is counted, should be carried out in the future. A more

detailed study of the timing of pupping and factors affecting pupping in Iceland is planned. An initiating pilot study on Vatnsnes peninsula, NW Iceland shows that the peak of the pup/adult ratio was reached 15<sup>th</sup> of June and that the main pupping period was late May/early June (Hauksson and Granquist 2016). Knowledge regarding genetics of the Icelandic harbour seal population is also scarce. Muscle samples from Icelandic harbour seals will be included in study on harbour seal DNA from several populations, together with among others the Natural History Museum of Denmark.

The condition of the harbour seal population was investigated by (Hauksson and Ólafsson 2016) by comparing blubber thickness on the lower end of sternum from seals caught in 1981, 1995 and 2009. The results showed that the blubber thickness was lower in 2009 compared to the two other years, both for female and male seals which indicate that the condition of the seals has aggravated. The reason for this needs further investigation.

## 5. SEAL INTERACTIONS WITH FISHERIES

Several dietary studies based on hard-part analysis, where fish otoliths and bones recovered from seal stomachs and faeces are analysed (Eldon 1977 cited in Bogason 1995; Hauksson and Bogason 1997; Nebel 2011; Hauksson et al. 2016), have been carried out on the Icelandic harbour seal population. Those studies indicated that harbour seals in Icelandic waters mainly feed on cod (*Gadus morhua*), but also on *Ammodytes* sp., redfish (*Sebastes* sp.), saithe (*Pollachius virens*), herring (*Clupea harregus*) and catfish (*Anarhichas lupus*) (Hauksson et al, 2016).

Due to a debate regarding the potential effect that harbour seals predation could have on salmonid species in Iceland (salmon (*Salmo salar*), Arctic charr (*Salvelinus alpinus*) and brown trout (*Salmo trutta*)), a study was initiated in 2009 where the diet of seals hauling out in estuary areas in NW Iceland was investigated. Several different methods were used to study the diet and the feeding behaviour of harbour seals hauling out in the estuary area of Bjargós and Ósar and the results suggest that salmon, charr and trout are in general not important prey species in the harbour seal diet (Granquist, 2014; Granquist and Hauksson, 2016a; Granquist and Hauksson, 2016b; Granquist et al., forthcoming). Instead, hard-part analysis showed that the most important diet were *Ammodytidae* and flatfishes (Granquist and Hauksson, 2016b). Preliminary results from prey-DNA analysis support the findings that salmon and trout are not an important prey for seals in the estuary area (Granquist et al. forthcoming). Ongoing stable isotope analysis of seal hair and muscle will further reveal information on the diet of seals in the area. A survey made in 2010 and 2011 among anglers in five important salmon rivers in NW Iceland (Viðidalsá, Gljúfurá, Fitjá, Vatnsdalsá and Miðfjarðará) showed that the proportion of salmon, charr and trout caught with wounds that could have been caused by seals (claw or teeth marks) was in most cases <1% of the harvest (Granquist, 2014). However, an investigation of harbour seal abundance in the estuary area of Ósar showed that seal abundance peaked during the summer and hence coincide with salmonid abundance in the estuary. That probably explain why harbour seals have been suspected to affect the salmonid population. However, Granquist and Hauksson (2016a) suggest that the reason for seal abundance in Ósar estuary is more likely to be due to pupping (late May/early June) and moulting (July/August) (Granquist and Hauksson 2016a). In 2013 a survey was carried out where seal effect on aquaculture

pens in Iceland was investigated and the results showed very little seal damage (Osmond 2013). It is important that these results are taken into consideration when managing harbour seal hunting around estuaries and aqua culture, especially when there is reason to believe that the harbour seal population has been decreasing substantially.

## 6. CONCLUDING REMARKS

There is a need to increase the knowledge on several parameters regarding the Icelandic harbour seal population. As mentioned, catch statistics needs to become more accurate and a convenient reporting system should be developed. It is of importance not only to know the number of the removed animals, but also age and gender of the removed individuals, which may affect the status of a population. Further, more knowledge on stock identity, such as fecundity and pup survival, as well as changes in distribution, would facilitate a better understanding of reasons for a declining trend in the population.

## 7. ACKNOWLEDGEMENTS

Thanks to Jón S. Ólafsson and Benóný Jónsson for valuable comments on earlier versions of this report.

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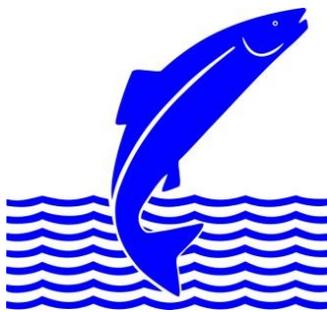
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## 9. APPENDIX

**Appendix table 1:** Harbour seals were aged in 2007 - 2010 (n=87; 50 females, 34 males and 3 animals of unknown sex).

Seal species	Harbour seal								
Year	2007								
		Age							
SEX	Pups	2					Total		
Females	5	1					6		
Males	8					8			
Sex unknown	1					1			
Total	14	1					15		
Year	2008								
		Age							
SEX	Pups	1	Not aged				Total		
Females	1				38			39	
Males	1	1				30	32		
Total	2	1	68				71		
Year	2009								
		Age							
SEX	Pups	1	2	3	10	Not aged	Total		
Females	13	1	2	1	1	21	39		
Males	4	3				20	27		
Sex unknown	2					2	2		
Total	19	4	2	1	1	41	68		
Year	2010								
		Age							
SEX	Pups	1	2	6	Not aged	Total			
Females	17	5	3				17	42	
Males	15			1	1	18	35		
Sex unknown					4	4			
Total	32	5	4	1	39	81			
All years 2007 - 2010									
		Age							
SEX	Pups	1	2	3	6	10	Not aged	Total	
Females	36	6	6	1				76	126
Males	28	4	1				68	102	
Sex unknown	3					4	7		
Total	67	10	7	1	1	1	148	235	



## Veiðimálastofnun

Keldnaholt, 112 Reykjavík

Sími 580-6300 Símbref 580-6301

[www.veidimal.is](http://www.veidimal.is) [veidimalastofnun@veidimal.is](mailto:veidimalastofnun@veidimal.is)



Ásgarður, Hvanneyri  
311 Borgarnes



Brekkugata 2  
530 Hvammstangi



Háeyri 1  
550 Sauðárkrókur



Austurvegur 3-5  
800 Selfoss