Introduction

The earliest description of the grey seal (*Halichoerus grypus*) (Fig. 1) can be traced to the mid-1700s in an account by Cneiff of the seal fishery in the Gulf of Bothnia (Allen 1880). Olafsen and Povelsen in their 'Reise igennem Island' , published in 1772, refer to the habits of the 'Útselur' and 'Vetrarselur' in Iceland, but the first systematic name has been attributed to Fabricius, who refers to the hook-nosed seal, Phoca grypus, in his "Seals of Greenland" published in 1790 (Kapel 2005). The grey seal was later assigned to its own genus, *Halichoerus*, which in Greek refers to sea pig. Thus *Halichoerus grypus* has the very unflattering scientific name, that translates to the hook-nosed sea pig. It is also known as the long-nosed seal, the Atlantic seal and in North America as horsehead.

Found only in the North Atlantic, 3 populations of grey seals are recognized: the Northeast Atlantic, the Northwest Atlantic and Baltic Sea. The Northeast Atlantic population diverged from the Northwest Atlantic population approximately 1 million years ago, while the Baltic Sea population diverged more recently from the Northeast Atlantic population, approximately 350,000 years ago (Boskovic *et al.* 1996). The Northeast Atlantic population is centred around the British Isles, ranging from Iceland, eastward along the coast of France, and north to Norway and the Kola Penninsula (Bonner 1981, Haug *et al.* 1994). The Northwest Atlantic population is found from the northeastern United States to Cape Chidley at the northern tip of Labrador (60° N), with the largest concentration around Sable Island, off the Nova Scotia coast (Lesage and Hammill 2001). The Baltic Sea population is concentrated in the central Baltic area, bounded by Sweden, Finland and Estonia (Harding and Härkönen 1999, Karlsson *et al.* 2005).

There is a long history of exploitation of grey seals. In North America skeletal remains have been found in native archaeological sites dating from the Archaic and Woodland Periods 250-8500 years B.P. (Black 2003, Pintal 2003). Grey seal numbers appear to have been severely reduced in eastern Canada by the mid 1800s (Lavigueur and Hammill 1993). By the late 1800s, the grey seal was considered to be one of the least abundant of the northern phocids, with their distribution restricted to a rather narrow range in Atlantic Canada, centred in the St Lawrence (Allen 1880). Exploitation also occurred in areas of the northeast Atlantic and grey seal remains have been detected in human middens in Iceland and the Faroe Islands from 800-1000 AD, reflecting the timing of human colonization of these areas (Church *et al.* 2005). Allen (1880) mentions the occurrence of the grey seal in Iceland and considered it common throughout northern Europe, as far north as Finnmark in Norway. However, he reported that grey seals were absent from the Arctic islands.

The perception that grey seals were rare continued well into the middle of the 20th Century (Smith 1966). Continued harvesting through

Fig. 1. *Grey seals in the water. The scientific name of the grey seal translates as "hook-nosed sea pig". (Photo: Jüssi)*

government culling and bounty programs appeared to have limited grey seal populations throughout their range (Smith 1966). However, as these activities declined during the later half of the century, grey seal populations appeared to have increased in many parts of their range (Smith 1966, Mansfield and Beck 1977, Harwood and Prime 1978, Hauksson 1985, Stobo and Zwanenburg 1990, Haug *et al.* 1994). Today, there is concern throughout their range that grey seals are having a negative impact on commercial fisheries, either through predation, transmission of the parasites, or by damaging fishing gear (Bowen 1990, Hauksson and Olafsdottir 1995, Mohn and Bowen 1996, Henriksen and Moen 1997, Cairns *et al.* 2000, Furness 2002, Moore 2003, Fjälling 2005, Jounela *et al.* 2006).

In 2001, the Scientific Committee of the North Atlantic Marine Mammal Commission noted that the abundance of grey seals around Iceland had declined from an estimated 12,000 animals in 1992, to 6,000 animals in 1998 and that the annual catch of around 500 animals might not be sustainable. In contrast, there were apparent increases in grey seal abundance in other areas including Norway, the United Kingdom and Canada. Grey seals had been assessed by NAMMCO in 1997 and 1998, but these assessments were dated and it was felt that a new assessment of grey seals in the North Atlantic was warranted (NAMMCO 2003). As a result, NAMMCO sponsored a working group on grey seals that met at the Marine Research Institute, in Reykjavik, Iceland, 9-11 April 2003 to review the information available on the status of all the grey seal populations. Since much of the information is unpublished or contained in government reports that are often difficult to access, it was decided that the papers presented should be compiled and published to make this information more widely available. This volume is the result.

The papers in this volume cover a wide range of topics. They begin with regional reviews of grey seals in the Baltic (Harding *et al.* 2007), along mainland European coasts (Härkönen *et al.* 2007) , in Norway (Nilssen and Haug 2007), Russia (Ziryanov and Mishin 2007), the Faroe Islands (Mikkelsen 2007), Iceland (Hauksson 2007a), United Kindom (Duck and Thompson 2007), and in the northwest Atlantic in eastern Canada (Hammill *et al.* 2007a) and the northeastern United States (Wood *et al.* 2007). These papers update information on abundance, the distribution (see also Henriksen *et al.* 2007) and status of grey seals in these areas.

Fig. 2. *The white coat of grey seal pups suggests an origin as an ice-breeding species, and ice-breeding remains common in the Gulf of St Lawrence and the Baltic. (Photo: Sonja Reder)*

Like many phocids, grey seal abundance is normally evaluated by determining the number of pups born in a season, usually using aerial surveys (Fig. 2). This approach provides an index of abundance, and if data on reproductive or mortality rates are available, total population size can be estimated. In the absence of such data, rough estimates of abundance can be obtained based upon assumed ratios of adults to pups obtained from other populations. However, the grey seal breeds in the fall or winter and our ability to count pups, particularly in the northern parts of its range may be limited by inclement weather and/or the absence of light. One alternative to the pup count approach would be to try to obtain estimates of grey seals using other components of the population surveyed at other times of the year. Hiby *et al.* (2007) present a new approach using a combination of photo-identification and mark-resighting methods to estimate abundance. This method focuses on older animals and there are still some challenges such as how to accommodate the dark coloration of males, or other segments of the population that are not available for re-sighting. However, the method has an added advantage of being able to estimate mortality rates in addition to abundance.

Based on information from the United Kingdom, grey seals in the northeast Atlantic, are considered to be much smaller than their northwest Atlantic counterparts (McLaren 1993). However, an analysis of growth and reproductive parameters indicates that there may be more variability in the population than previously thought. Iceland grey seals are larger than animals from the United Kingdom and are similar in size to grey seals from the northwestern Atlantic (Hauksson 2007b). The grey seal population in Iceland appears to have declined by over 50% since the early 1990's and the current population may only be in the order of 5,000 animals (Hauksson 2007b). High reproductive rates and an early age at first reproduction suggest a density dependent response to the population decline.

Understanding their diets is crucial for determining the role that seals play in the marine ecosystem, and forms one component in the question of evaluating the impact of grey seals on commercial fisheries. However, the collection and analysis of diet data are labour intensive, there is often considerable spatial and temporal variability and the potential biases associated with different samples and/or analyses are poorly understood. Throughout their range grey seals are piscivorous; important prey items include 1 or more high energy species such as capelin (*Mallotus villosus*), sandlance (*Ammodytes sp*), herring (*Clupea harengus*), or mackerel (*Scomber scombrus*) as well as gadoids and flatfish. The majority of prey are 15-30 cm in length, but in some areas where wolffish or catfish (*Anarhichas sp.*) are important prey they tend to be quite large (>50 cm) (Mikkelsen 2007). Hammill *et al.* (2007) examined gastro-intestinal tracts from grey seals and showed a reduction in the importance of cod in the diet between samples collected before and after the collapse of cod stocks that occurred during the early 1990s in eastern Canada. At Sable Island, an analysis of faecal samples showed that grey seals positively selected for sandlance, while other species were avoided or consumed roughly in proportion to their estimated abundance (Bowen and Harrison 2007). In the Baltic Sea, samples from hunted, bycatch and stranded animals showed that freshwater species are also often consumed by grey seals (Lundström *et al.* 2007) in this area.

Interactions between fisheries and seals can include damage to catches and gear, which are often not appreciated by the urban community but may have a significant impact on individual fishermen (Königson *et al.* 2007). An understanding of factors that may attract grey seals to fishing gear might contribute to reducing conflicts between this coastal seal and fishermen (Fjälling *et al.* 2007).

Marine mammal resource management involves conservation, hunt management, and/or fisheries interaction issues. The relative role of each of these varies between regions and nations. The recovery of grey seal stocks throughout much of its range represents a conservation success story for these areas. At the same time, managers are now faced with other challenges. In this volume, we have provided an overview of grey seal status as well as some interesting ecological information, that we feel will be useful to managers, as well as stakeholders interested in marine mammal issues.

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