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ORIGINAL PAPER

Reproductive rate and nutritional status of Baltic ringed seals

Kaarina Kauhala[1] · Mikaela Bergenius[2] · Marja Isomursu[3] · Jari Raitaniemi[1]

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Abstract
The Baltic ringed seal (*Pusa hispida botnica*) population started to increase in numbers in the 1990s after a population decrease caused by hunting and environment pollutants. The annual growth rate of this population is about 5%, while in a fast-growing seal population, it could be as high as 10–12%. The reasons behind the fairly slow population growth rate are not known. In the current study, we investigated reproductive rate and nutritional status of ringed seals in the Bothnian Bay, the largest subpopulation in the Baltic Sea. The aims of the present study were (1) to estimate reproductive rate of females and (2) to examine especially annual variation in nutritional status (blubber thickness) in relation to prey quality and quantity as it affects reproductive rate. The proportion of females with *corpus albicans* (an estimate of birth rate) in Baltic ringed seals has increased from low values since the late 1990s and is at present about 72%. It was highest among females at the age of 5–12 years and declined thereafter, especially after the age of 20. Uterine occlusions, which earlier caused sterility to females, were rare in recent years. Blubber thickness of both pups and older seals decreased during spring and increased during the rest of the year. Average blubber thickness of sub-adults and adults declined until the early 2000s and increased thereafter, except in adult females, and correlated positively especially with average weight of herring (*Clupea harengus*). In sub-adults, blubber thickness correlated also with the weight and catch size of vendace (*Coregonus albula*). These results suggest that the quality and quantity of important prey fish may affect the nutritional status of seals. In recent years, average blubber thickness of adult females in spring declined, although herring quality increased. This may be partly due to stress caused by poor ice conditions in the nursing period in late winter. The declining nutritional status of adult females may, at least partly, be responsible for the relatively low birth rate and population growth rate of ringed seals in the Bothnian Bay.

Keywords Birth rate · Body condition · Herring · *Pusa hispida* · Vendace

Introduction

The Baltic ringed seal (*Pusa hispida botnica*) numbers decreased from about 200,000 in the beginning of the twentieth century to only about 5000 individuals in the 1970s. The main reason behind the decline was bounty hunting (which was stopped in 1975; Harding & Härkönen 1999). Furthermore, females of both ringed and gray seals (*Halichoerus grypus*) suffered from uterine occlusions causing sterility in the beginning of 1970s, probably caused by environmental pollutants, especially PCBs (Helle et al. 1976; Helle 1979, 1980; Bergman 1999). Since hunting of ringed seals was prohibited in 1980 in the Soviet Union, 1986 in Sweden, and 1988 in Finland (Härkönen et al. 1998) and concentrations of organochlorines declined in the Baltic Sea the ringed seal population started to grow slowly in the 1990s, and the numbers are still increasing. The annual growth rate of the population is about 5%, while in a fast-growing seal population, it could be up to 10–12% (Harding et al. 2007). About 10,000 ringed seals live

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✉ Kaarina Kauhala
kaarina.kauhala@luke.fi

Mikaela Bergenius
mikaela.bergenius@slu.se

Marja Isomursu
Marja.isomursu@evira.fi

[1] Natural Resources Institute Finland (Luke), Luke, Itäinen Pitkäkatu 4 A, 20520 Turku, Finland

[2] Department of Aquatic Resources, Institute of Marine Research, Swedish University of Agricultural Sciences, Turistgatan 5, 453 30 Lysekil, Sweden

[3] Finnish Food Safety Authority Evira, Veterinary Bacteriology and Pathology Research Unit, Wild and Aquatic Animal Pathology Section, Elektroniikkatie 3, 90590 Oulu, Finland

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