

Possible effects of previous catch on the present population of Norwegian killer whales (*Orcinus orca*)

Dag Vongraven¹ and Anna Bisther²

¹Department of Zoology, University of Trondheim-AVH, Dragvoll, Norway; and ²Kristineberg Marine Research Station, University of Gothenburg, 45 034 Fiskebäckskil, Sweden

Abstract. Intensive coastal killer whale catches undertaken in the two decades after 1960 (especially in 1969, 1970 and 1979), might have had effects on reproduction and social behaviour in the present Norwegian killer whale community. The catch was both sex- and age-biased, and this might have triggered compensatory mechanisms. Our approach when studying the social ecology of Norwegian killer whales must take into account the possible presence of such mechanisms. Further modelling studies are in progress.

Key words: killer whales, catch data, reproduction, social ecology

Introduction

The killer whale population off the Norwegian coast has previously been subjected to a hunting pressure with unknown effects upon the present population. Results and insights from an on-going photo-ID study indicate that this population is stationary and has evolved complex social behaviour.

Other species of long-lived, slow-reproducing mammals that live in socially structured societies have been shown to respond to hunting with changes in social strategies, either as an effect of a reduced population density (i.e. simakobu monkey *Nasalis concolor* [1]) or as an effect of selective takes of large and old individuals (i.e. elephants *Loxodonta africana* [2]). Could peaks in the catch of killer whales one generation ago have had any other effects than a reduced size of the present population?

Materials and Results

There are official catch records of 2435 killer whales caught in the North Atlantic in the period from 1938 to 1981. Of these, 64% were caught in the coastal waters off Norway. Twenty-nine percent of the total catch in the whole period occurred in the three seasons 1969 (231), 1970 (246) and 1979 (221), and 91% of these were caught in the coastal fishery zones. Temporal and spatial intensity is especially characteristic of the catch during these years, during which the majority of the whales were caught

Address for correspondence: D. Vongraven, Department of Zoology, University of Trondheim-AVH, 7055 Dragvoll, Norway.

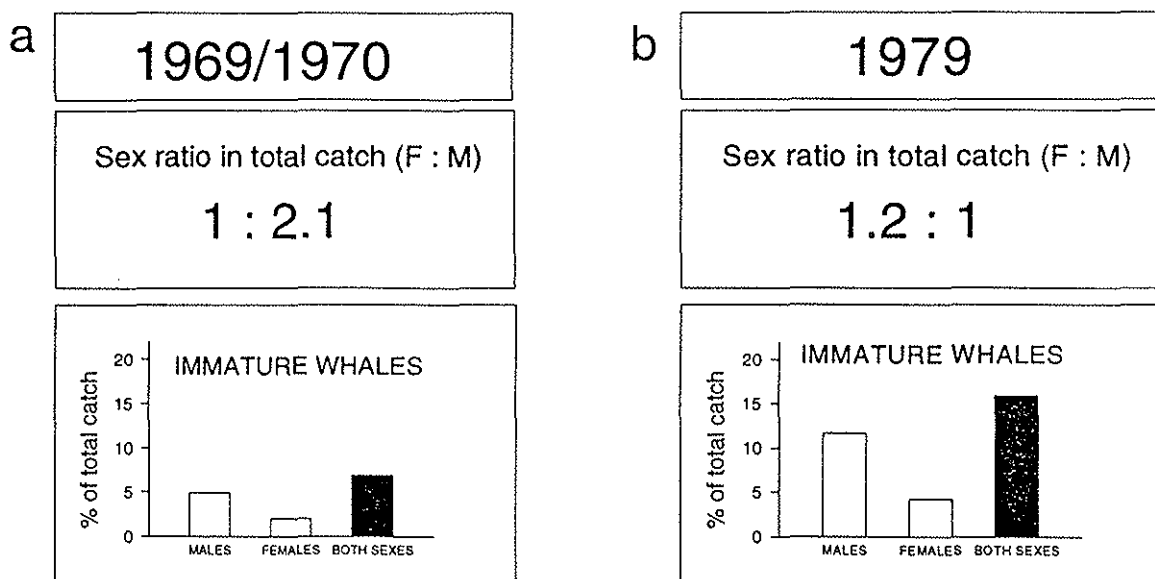


Fig. 1. Characteristics of the Norwegian killer whale catch, depicting the sex- and age-biases in the peak seasons (a) 1969 and 1970; and (b) 1979.

in the space of 1–2 months within a single fishery zone every season. The 1969/1970 catch was concentrated in the Møre region, while the 1979 catch was concentrated in Lofoten.

Females are sexually mature at an average length of 15 ft, and males at 18 ft [3]. Seventy-one percent of the total catch was recorded after 1960, and the fraction of immature whales in the same period was 11.9%. The corresponding fraction for the two high intensity years 1969 and 1970 was 6.9%, and for 1979 15.9%. Of all the whales caught after 1960, a fraction of only 4.2% were smaller than 15 ft (Fig. 1).

The overall sex ratio for sexually mature whales is close to 1:1.3 (females/males) for all seasons. However, there are large variations between years. The sex ratio for the two seasons 1969/1970 was 1:2.1, whereas the sex ratio for the 1979 season was 1.2:1 (Fig. 1). There was a switch from a female-biased to a male-biased sex ratio at lengths above 19 ft.

Discussion

There are two factors that indicate that the catch in the peak seasons could be regarded as high compared to the total size of the killer whale community. First, a total number of identified whales in the range of 5–700 individuals and fractions of resightings of 65% and 90% in the two on-going photo-ID studies off the Norwegian coast indicate that a population size much bigger than this is improbable (Similä personal communication; Bisther and Vongraven, unpublished data). Second, the female bias in the catch from 1979 could be considered as a direct effect of the male-biased catch from previous years, and especially the 1969/1970 catch, if population size was in the size range previously suggested.

There is an obvious size bias in the catch from these peak seasons. Given that young whales rely on nursing and care-taking from adult whales for survival, the relative absence of calves and juveniles in the latest catch records could have led to an increase in their future mortality as many parents and potential care-giving individuals were removed. In the Pacific Northwest, when comparing two populations of killer whales with different exploitation histories, Bain [4] found a neonate mortality of 63% in the cropped population and 41% in the uncropped population, whereas adult survivorship was similar. A tendency towards a higher juvenile mortality (up to an age of 15 years) in cropped than in uncropped pods has also been shown by Olesiuk et al. [5].

Live-capture fishery for killer whales in the North-American Pacific Northwest removed approx. 25% of the initial population in the period 1964–1975 [6]. If the population size of Norwegian killer whales in the 1960s was in the order of magnitude previously suggested, then the “coastal” fraction of the 477 whales caught in 1969 and 1970 would at least represent a similar fraction of the population at that time.

Findings like these point to the fact that killer whale reproduction depends on social as well as on density dependent determinants. It is also easier to comprehend compensatory mechanisms being induced on a group level rather than on an overall reduced density in the whole area inhabited by the population [7]. Destruction of social structures caused by biased removal of individuals from the population could account for some of the loose group structure suggested by our data.

Further modelling studies with basis in the catch data will be carried out. By means of different scenarios for population status and catch regime, and previously published vital rates, we will try to investigate what possible effects the catch might have had on the social structure of the population. Finally, we wish to place the emphasis on the potential importance of the catch, and on the influence this ought to have on our approach when studying the social system of Norwegian killer whales.

References

1. Watanabe K. Variations in group composition and population density of two sympatric mentawaiian leaf-monkeys. *Primates* 1981;22:145–160.
2. Eltringham SK. *Elephants*. Blandford Books, 1982;52–56.
3. Christensen I. 1982. Killer whales in Norwegian coastal waters. *Rep Int Whal Commn* 1982;32:633–641.
4. Bain DE. An evaluation of evolutionary processes. Ph.D. Thesis, University of California, Santa Cruz, 1988.
5. Olesiuk PF, Bigg MA, Ellis GM. Life history and population dynamics of resident killer whales *Orcinus orca* in the coastal waters of British Columbia and Washington State. *Rep Int Whal Commn* 1990;(Special Issue 12):209–243.
6. Bigg MA, MacAskie IB, Ellis G. Abundance and movements of killer whales off eastern and southern Vancouver Island with comments on management. Preliminary Report, Arctic Biological Station, Ste. Anne de Bellevue, Quebec, 1976.
7. Fowler CW. Density dependence in cetacean populations. *Rep Int Whal Commn* 1984;(Special Issue 6):373–379.