

## NAMMCO Scientific Publications - Volume 2

### Minke Whales, Harp and Hooded Seals: Major Predators in the North Atlantic Ecosystem

#### ABSTRACTS

#### Food consumption estimates of Barents Sea harp seals

Nilssen, K.T., Pedersen, O.P., Folkow, L.P. and Haug, T. 2000. Food consumption estimates of Barents Sea harp seals. *NAMMCO Sci. Publ.* 2:9-28.

The consumption of various prey species, required by the Barents Sea harp seal (*Phoca groenlandica*) stock in order to cover their energy demands, has been estimated by combining data on the energy density of prey species and on seasonal variations in the energy expenditure and body condition of the seals. Data on diet composition and body condition were collected in the period 1990-1996 by sampling harp seals during different seasons, in various areas of the Barents Sea. All diet composition data were based on reconstructed prey biomass, and adjustments were made for differences in digestibility of crustaceans and fish. The number of seals representing different age and sex groups were calculated for the entire population, and the monthly food requirements were estimated.

In 1998, the total Barents Sea harp seal stock was estimated to comprise 2.22 million seals based on a mean production of 301,000 pups. After adjustments for a pup mortality of 30% its total annual food consumption was estimated to be in the range of 3.35-5.05 million tonnes (depending on choice of input parameters). Assuming that there are seasonal changes in basal metabolic rate associated with changes in body mass, and that the field metabolic rate of the seals corresponded to two times their predicted basal metabolic rate, the annual food consumption of the Barents Sea harp seal stock was estimated. If capelin (*Mallotus villosus*) was assumed to be abundant, the annual total consumption was estimated to be 3.35 million tonnes, of which 1,223,800 tonnes were crustaceans, 807,800 tonnes were capelin, 605,300 tonnes were polar cod (*Boreogadus saida*), 212,400 tonnes were herring (*Clupea harengus*), 100,500 tonnes were cod (*Gadus morhua*) and 404,200 tonnes were "other fish". A very low capelin stock in the Barents Sea (as it was in the period 1993-1996) led to switches in seal diet composition, with increased consumption of polar cod (from ca. 16%-18 % to ca. 23%-25 % of total consumption), other gadoids (dominated by cod, but also including haddock (*Melanogrammus aeglefinus*) and saithe (*Pollachius virens*)), herring, and "other fish". Using the same set of assumptions as in the previous estimate, the total consumption would have been 3.47 million tonnes, divided between various prey species as follows (in tonnes): polar cod 876,000, codfish (cod, saithe and haddock) 359,700, "other fish" 618,800, herring 392,500, and crustaceans 1,204,200. Overall, the largest quantities of food were estimated to be consumed in the period June-September.

In 1999, the total Barents Sea harp seal stock size is estimated to be 2.18 (95% CI, 1.79 to 2.58) million animals, which would give an annual food consumption in the range of 2.69

– 3.96 million tonnes (based on upper and lower 95% confidence limits and adjusted for a pup mortality rate of 0.3) if capelin is assumed to be abundant.

### **First independent feeding of harp seal (*Phoca groenlandica*) and hooded seal (*Cystophora cristata*) pups in the Greenland Sea**

Haug, T, Nilssen, K.T. and Lindblom, L. 2000. First independent feeding of harp seal (*Phoca groenlandica*) and hooded seal (*Cystophora cristata*) pups in the Greenland Sea. *NAMMCO Sci. Publ.* 2:29-39.

Data were collected from harp seal (*Phoca groenlandica*) and hooded seal (*Cystophora cristata*) pups belonging to the Greenland Sea (or "West Ice") stocks in 1995-1997. Pups of both species were observed to feed independently shortly after weaning, and their first food was almost exclusively crustaceans. *Parathemisto* sp., particularly *P. libellula*, dominated the diet of both the harp and the hooded seal pups, but the diet also contained sympagic amphipods of the genus *Gammarus*. Krill (*Thysanoessa* sp.) was of minor importance as food for seal pups in 1995, but occurred more frequently in the diet of both species in 1996 and 1997. Considerable niche overlap may suggest some interspecific competition between harp and hooded seal pups in the West Ice.

### **Feeding habits of harp (*Phoca groenlandica*) and hooded seals (*Cystophora cristata*) during late winter, spring and early summer in the Greenland Sea**

Potelov, V., Nilssen, K.T., Svetochev, V. and Haug, T. 2000. Feeding habits of harp (*Phoca groenlandica*) and hooded seals (*Cystophora cristata*) during late winter, spring and early summer in the Greenland Sea. *NAMMCO Sci. Publ.* 2: 40-49.

Diet data were collected in the Greenland Sea pack ice (the West Ice) from March to June from harp seals (*Phoca groenlandica*) in 1987, 1990-1992 and 1997, and from hooded seals (*Cystophora cristata*) in 1992 and 1994, during Soviet/Russian commercial sealing and on Norwegian scientific expeditions. The majority of both harp and hooded seal stomachs were empty but intestinal contents were found in most of the seals. The harp seal diet was totally dominated by the amphipods *Parathemisto* sp. and *Gammarus* sp., but krill (*Thysanoessa* sp.) and polar cod (*Boreogadus saida*) were also eaten quite frequently. Hooded seals had been feeding mainly on the squid *Gonatus fabricii*, which was found most frequently in the intestines, but which also dominated in the few stomachs with contents. Polar cod also occurred quite frequently in the hooded seal diet, while crustaceans, such as amphipods and krill, occurred only sporadically.

### **Feeding habits of harp and hooded seals in Greenland waters**

Kapel, F.O. 2000. Feeding habits of harp and hooded seals in Greenland waters. *Nammco Sci. Publ.* 2: 50-64.

Results of stomach contents analyses of harp and hooded seals collected in West Greenland waters in the period 1986-1993 are reviewed, and compared with published

data and circumstantial information from local hunters.

The diet of harp seals in this region is variable but consists mainly of pelagic crustaceans (*Thysanoëssa* ssp. and *Parathemisto libellula*) and small fish species like capelin (*Mallotus villosus*), sandeel (*Ammodytes* ssp.), polar cod (*Boreogadus saida*) and Arctic cod (*Arctogadus glacialis*). Species of importance for commercial fisheries in Greenland, such as Northern prawn (*Pandalus borealis*), Atlantic cod (*Gadus morhua*), and Greenland halibut (*Reinhardtius hippoglossoides*) play a minor role in the diet of harp seals in this area.

Variation in the diet of hooded seals is less well documented, but in addition to the species also taken by harp seals, larger demersal fishes like Greenland halibut, redfish (*Sebastes* ssp.), cod, and wolffish (*Anarhichas minor*) are apparently important prey items.

### **Estimated food consumption of minke whales *Balaenoptera acutorostrata* in Northeast Atlantic waters in 1992-1995**

Folkow, L.P., Haug, T., Nilssen, K.T. and Nordøy, E.S. 2000. Estimated food consumption of minke whales (*Balaenoptera acutorostrata*) in Northeast Atlantic waters in 1992-1995. *NAMMCO Sci. Publ.* 2:65-81.

Data on energy requirements, diet composition, and stock size were combined to estimate the consumption of various prey species by minke whales (*Balaenoptera acutorostrata*) in Northeast Atlantic waters. In the period 1992-1995, the stock of 85,000 minke whales appeared to have consumed more than 1.8 million tonnes of prey per year in coastal waters off northern Norway, in the Barents Sea and around Spitsbergen during an assumed 6 month stay between mid-April and mid-October. Uncertainties in stock estimates suggest a 95% confidence range of 1.4 – 2.1 million tonnes. The point estimate was composed of 602,000 tonnes of krill (*Thysanoëssa* spp.), 633,000 tonnes of herring (*Clupea harengus*), 142,000 tonnes of capelin (*Mallotus villosus*), 256,000 tonnes of cod (*Gadus morhua*), 128,000 tonnes of haddock (*Melanogrammus aeglefinus*) and 54,500 tonnes of other fish species, including saithe (*Pollachius virens*) and sandeel (*Ammodytes* spp). Consumption of various prey items by minke whales may represent an important mortality factor for some of the species. For example, the estimated annual consumption of herring corresponds to about 70% of the herring fisheries in the Northeast Atlantic in 1995. Minke whale diets are subject to year-to-year variations due to changes in the resource base in different feeding areas. Thus, the regional distribution of consumption of different prey items is highly dynamic.

### **A note on stomach contents of minke whales (*Balaenoptera acutorostrata*) in Icelandic waters**

Sigurjónsson, J., Galan, A. and Víkingsson, G.A.. 2000. A note on stomach contents of minke whales (*Balaenoptera acutorostrata*) in Icelandic waters. *NAMMCO Sci. Publ.* 2: 82-91.

There is limited available information on food habits of minke whales (*Balaenoptera acutorostrata*) in coastal Iceland. Sixty-eight minke whales were examined for stomach contents; 51.5% contained fish only, 22.1% krill (*Euphausiacea*) only, 25.0% fish and krill together, and one animal (1.5%) had no food remains in the stomach. The fish species identified were capelin (*Mallotus villosus*), sandeels, (*Ammodytidae*), cod (*Gadus morhua*) and herring (*Clupea harengus*). Two species of krill were identified; (*Thysanoessa raschii*) and (*Meganyctiphanes norvegica*) . Sandeel was the dominant prey species in the western and southwestern areas, while capelin and krill were more frequently found in animals sampled in North Iceland.

### **The diet of the minke whale in Greenland - A short review**

Neve, P.N. 2000. The diet of the minke whale in Greenland - a short review. *NAMMCO Sci. Publ.* 2:92-97.

Information on the diet of minke whales (*Balaenoptera acutorostrata*) in Greenland waters is reviewed. The knowledge is based on reports by whale catchers in Greenland, supplemented by limited scientific studies of stomach contents. The available material indicates that capelin (*Mallotus villosus*) is the predominant prey item in Greenland waters, particularly in coastal areas. In offshore areas, sand eel (*Ammodytes* ssp.) is consumed rather frequently, and krill (*euphausids*) appears to play a certain role in some areas or periods.

### **Who eats whom in the Barents Sea?**

Bogstad, B., Haug, T. and Mehl, S. 2000. Who eats whom in the Barents Sea? *NAMMCO Sci. Publ.* 2: 98-119.

An overview of the estimates of consumption by predators on the main fish stocks in the Barents Sea is given. The main predators are cod (*Gadus morhua*), harp seal (*Phoca groenlandica*) and minke whale (*Balaenoptera acutorostrata*). The results indicate that cod is the most important predator, consuming about as much food annually as harp seals and minke whales combined. The consumption estimates, together with data on the amount of fish removed by commercial fisheries, are compared to estimates of the abundance and removal through natural mortality of the various species of fish prey. The consistency between these estimates is discussed. The natural mortality values for cod and haddock used in assessments are found to be reasonably consistent with the consumption estimates. The consumption of capelin is found to be higher than what is available for predation in years of low capelin abundance, while in years of high herring abundance the consumption does not explain all the mortality. The way in which the consumption estimates are and can be utilised in the assessment and management of fish stocks in the Barents Sea using multispecies models and approaches is described.

## **Direct and indirect effects of minke whale abundance on cod and herring fisheries: A scenario experiment for the Greater Barents Sea.**

Schweder, T., Hagen, G.S. and Hatlebakk, E. 2000. Direct and indirect effects of minke whale abundance on cod and herring fisheries: A scenario experiment for the Greater Barents Sea. *NAMMCO Sci. Publ.* 2:120-132.

To study the pattern of interaction between minke whale (*Balaenoptera acutorostrata*) abundance and the main fisheries in the Greater Barents Sea, a simulation experiment was carried out. The population model involves 4 species interconnected in a food web: cod (*Gadus morhua*), capelin (*Mallotus villosus*), herring (*Clupea harengus*) and minke whales. Minke whales are preying on cod, capelin and herring; cod are preying on (young) cod, capelin and herring; herring in the Barents Sea are preying on capelin; while capelin is a bottom prey in the model. The consumption function for minke whales is non-linear in available prey abundance, and is estimated from stomach content data and prey abundance data. The model is dynamic, with a time step of one month, and there are two areas: the Barents Sea and the Norwegian Sea. Minke whale abundances are kept on fixed levels, while recruitment in fish is stochastic.

Cod and herring fisheries are managed by quotas targeting fixed fishing mortalities, while capelin is managed with a view to allow the cod to have enough food and leaving a sufficient spawning stock of capelin. The model is simulated over a period of 100 years for a number of fixed levels of minke whale abundance, and simulated catches of cod, herring and capelin are recorded.

The experiment showed interactions between whale abundance and fish catches to be mainly linear. For cod catches, both the direct effect of whales consuming cod, and the indirect effect due to whales competing with cod for food and otherwise altering the ecosystem, are linear and of equal importance. The net effect on the herring fishery is of the same magnitude as the net effect on the cod fishery, with each extra whale reducing the catches of both species by some 5 tonnes. These conclusions are conditional on the model and its parameterisation.