

Short communication

Gonatus fabricii (Mollusca, Theuthida) as an important food source for sperm whales (*Physeter macrocephalus*) in the Northeast Atlantic

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An analysis of cephalopod beaks from the stomachs of 10 sperm whales stranded in Denmark during 1991, 1997 and 2000 revealed *Gonatus fabricii* as the dominant prey species (>98% of 2536 identified lower beaks). Other species found were: *Todarodes sagittatus*, *Histioteuthis* sp., *Cycloteuthis* sp., *Haliphron atlanticus*, and *Bathyteuthis* sp. The majority (73.5%, n = 2522) of the *Gonatus fabricii* lower beaks were from individuals with an estimated mantle length between 192 and 257 mm, corresponding with the length of mature ontogenetically transformed immobilized females. The results may therefore further support sperm whale predation in the North Atlantic upon an immobile squid stage.

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INTRODUCTION

Mass and single strandings of sperm whales (*Physeter macrocephalus* L., 1758) were recorded along the Danish North Sea coast in 1991, 1996, 1997 and 2000 (Kinze 1995; Kinze & al. 1998; Kinze unpublished data). It is believed that the whales, due to a navigation error, enter the North Sea during their migration from Norwegian waters to the southern mating areas and eventually perish in the shallow tidal areas of the southern North Sea (Smeenk & Addink 1993).

Gonatus fabricii (Lichtenstein, 1818) (Oegopsina, Gonatidae) is the most abundant decapod in the North Atlantic (Kristensen 1984; Bjørke & Gjøsæter 1998) and recent stomach analyses of stranded sperm whales in the North Atlantic have identified *Gonatus fabricii* as the dominant cephalopod in the prey species (Lick & al. 1995; Santos & al. 1999, 2002; Bjørke 2001).

Here we present and discuss additional information from three recent Danish sperm whale strandings.

MATERIAL AND METHODS

Stomach contents were retrieved from 10 animals originating from three sperm whale strandings that occurred in 1991, 1997 and 2000.

The sperm whale carcasses were secured and examined within the framework of the Danish Contingency Plan for Marine Mammals and Sea Birds (Jepsen 1997). The 1991 stranding involved three animals of which two were sampled; 13 animals were stranded in 1997, of which seven were sampled; the sample from 2000 was obtained from a single animal that stranded alone.

The cephalopod contents of the stomachs, consisting of beaks only, were stored in 80% alcohol, and identified to species level or the nearest possible taxonomical category using a species identification key (Clarke 1986) and the reference collection of the Zoological Museum, University of Copenhagen, Denmark.



All lower beaks were measured to the nearest 0.05 mm using a calliper. The lower rostral length of the decapod beaks and the hood length of the octopod beaks were used to estimate the mantle length of each individual. Available correlations between lower rostral length and mantle length were used to estimate mantle length (Clarke 1980; Perez-Gandaras 1983).

RESULTS

In total, 2536 cephalopod lower beaks were identified in the sperm whale stomachs. More than 98% of the beaks in each whale stomach were identified as belonging to *Gonatus fabricii*. Besides *Gonatus fabricii*, the following taxa were identified: *Todarodes sagittatus* (Lamarck, 1798) (Oegopsina, Ommastrophidae), *Histioteuthis* sp. (Oegopsina, Histioteuthidae), *Cycloptereuthis* sp. (Oegopsina, Cycloptereuthidae), *Haliphron atlanticus* (Incirrina, Alloposidae), and *Bathyypolypus* sp. (Incirrina, Octopodidae).

The majority (73.5%, n = 2522) of the lower beaks of *Gonatus fabricii* ranged in size from 5.5 to 7.0 mm (lower rostral length) corresponding to a mantle length of 192–257 mm, indicating that most beaks belonged to mature individuals.

DISCUSSION

Female *Gonatus fabricii* reach maturity at a size of 200–250 mm (mantle length) (Bjørke & Hansen 1996). After mating, they undergo comprehensive ontogenetic changes. The muscle tissue gelatinizes and the tentacles and suction cups on the arms degenerate (Kristensen

1981; Bjørke & Hansen 1996; Arkhipkin & Bjørke 1999); these changes result in the females losing their swimming ability (Arkhipkin & Bjørke 1999). Arkhipkin & Bjørke (1999) suggested that the *Gonatus fabricii* female body then serves as a floatation device for the negatively buoyant eggs. The females remain in this stage for approximately 1 year, after which the eggs hatch and the females presumably perish (Arkhipkin & Bjørke 1999; Bjørke 2001). It has been suggested that sperm whales in the North Atlantic may prey selectively upon these immobilized female *Gonatus fabricii* (Clarke 1980; Santos & al. 1999). The length distribution of *Gonatus fabricii* found in the present study corresponds with that found for mature individuals, supporting earlier findings (Lick & al. 1995; Clarke & Pascoe 1997; Santos & al. 1999, 2002). Thus, the results of this study add weight to the theory that sperm whales in the North Sea and/or adjacent waters forage heavily on ontogenetically immobilized *Gonatus fabricii* females. Given the enormous biomass of *Gonatus fabricii* in the Norwegian Sea (Bjørke & Gjøsæter 1998), such females would make an abundant and easy to catch prey indeed.

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