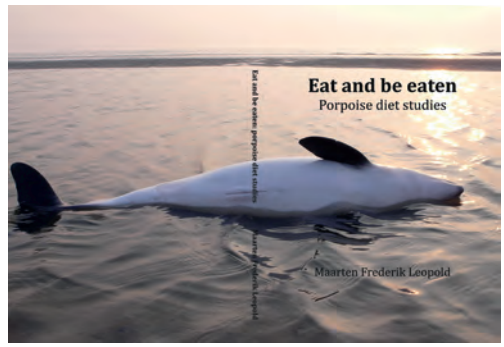
Eat and be eaten



Eat and be eaten - Porpoise diet studies. Maarten F. Leopold 2015. PhD thesis. Wageningen University, Wageningen, the Netherlands. 239 pp. ISBN 978-94-6257-558-5.

On 20 November 2015 Maarten Frederik (Mardik) Leopold successfully defended his PhD thesis *Eat and be eaten*. Leopold has been working on diets of fish eating bird species for about half a lifetime. These diet studies were based on the identification of remains of hard parts of prey species in birds' stomachs, mainly otoliths, the ear bones of fish. In the course of time Leopold built a reference collection that made it possible to use otoliths to not only identify the fish species but also their length and/or mass (Leopold et al. 2001).

Two events triggered the genesis of this thesis. The first was a mass necropsy of harbour porpoises (*Phocoena phocoena*) in 2006, providing a fair number of stomachs to study the diet of porpoises (Leopold & Camphuysen 2006). These stomachs were followed by tens of others in the subsequent years. The second event was the discovery in 2014 that beached porpoises supposedly mutilated by fishermen were victims of grey seal (*Halichoerus grypus*) attacks. This phenomenon made it easier to structure the PhD thesis: harbour porpoises as predator and as prey. *Eat and be eaten* was conceived.

The subtitle of the thesis, *Porpoise diet studies,* is an understatement. Not only data from diet analyses from 2006-2014 are presented, but the phenomenon of grey seal attacks on porpoises is described in full detail as well. Four chapters describe the results of diet studies. Another three chapters deal with grey seal as a predator of porpoise.

The results of diet analyses of a large sample size of porpoise confirm that *the* diet of the harbour porpoise does not exist. Though the overall diet of porpoises consists of four main fish groups (gobies, gadoids, herring-like species and sandeel), age, sex, stranding location, feeding location (estuarine, coastal or offshore, bottom or pelagic), time of year etc. are factors that influence the individual porpoise's diet. Age and size of a porpoise are important factors in discriminating differences. After weaning, a young porpoise starts feeding on gobies, which are small low-energetic fish. To sustain itself a young animal needs ca. 2000 gobies a day. An adult would need ca 5000 gobies a day, i.e. an average of more than three gobies per minute, round the clock. Physically this seems impossible. Thus, whilst growing, porpoises are supposed to switch to larger prey of a higher energy density. And that's exactly what Leopold found: clupeids and sandeels were the most abundant prey species in older and bigger porpoises.

Another interesting result Leopold found is that many porpoises are emaciated. Stomachs of these animals often contained food remains. Compared to the diet of well-nourished individuals the emaciated animals had fewer prey remains, and prey of lower quality (less fatty fish) in their stomach. On the extreme end of this range several animals had empty stomachs; they were most often found in summer. The author concludes that life is not easy for a porpoise in the southern North

Sea in summertime.

In Dutch coastal waters, the life of a porpoise is not easy either. From incidental observations it was known that grey seals can attack porpoises (i.e. Bouveroux et al. 2012). This phenomenon was never quantified. Until DNA in fresh supposedly grey seal induced wounds of three porpoises was analysed and identified as grey seal, constituting definitive evidence that grey seals attack porpoises and not only incidentally. Characteristics of the bite wounds and other mutilations of these three animals were used to conduct a retrospective study using photographs of dead porpoises necropsied in the Netherlands from 2003-2013. It turned out that ca. 25% of the dead porpoises were victim of a grey seal attack. The grey seal victims showed two different patterns. Porpoises containing bottom dwelling prey species (thus feeding near the seafloor) had zigzag wounds, whilst porpoises containing pelagic or surface prey species (thus feeding in the water column) showed wounds on the throat or cheek. The relationship between the attack wounds and attack-specific diet strengthened the idea that grey seals attack living porpoises while feeding. Stomach content as circumstantial evidence. Stomach content was shown to aid in identifying bycatch by bottom-set gillnets as well. Presumed bycatch victims fed on bottom dwelling species.

Though analysis of stomach contents can provide answers to many questions, caveats in knowledge remain, amongst others: diet of porpoises further offshore (e.g from bycaught animals) and differences between diets in the North Sea and in estuaries. I would encourage the author to investigate how the diet found by stomach content analysis (last meal) reflects diet on the longer time scales found by fatty acid analysis and stable isotope analysis (cf. Janssen 2013). As Leopold states in his thesis, there are plenty of topics to be addressed in the future. I can only hope that he finds time, funding, and new so-called *maagmeisjes* ('stomach girls', male or female) to assist in analysing many more porpoise stomachs.

References

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