

A noninvasive molecular method for diet determination from toothed whale fecal samples

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Understanding of the foraging ecology and ecological niche of deep-diving odontocete predators is limited by the lack of noninvasive techniques to determine diet. Most knowledge of marine mammal diets comes from identification of hard parts in stomach contents or feces (which limits recognizable prey to those with suitable hard parts). Polymerase chain reaction (PCR) has also been used to detect specific prey items in mammalian feces, but application of that method requires foreknowledge of expected prey. We have developed a noninvasive molecular method for diet determination using prey DNA isolated from fecal samples. We have successfully applied the method to one Blainville's beaked whale (*Mesoplodon densirostris*) fecal sample, and anticipate analysis of 42 more samples from Blainville's beaked whales (13), sperm whales (28), and bottlenose dolphins (2), all collected near Abaco, Bahamas in 2001-2004. We PCR-amplified fragments of two mitochondrial genes using degenerate primers originally designed for studies of fish, mollusk, and invertebrate phylogeny. We cloned and sequenced the resulting PCR products, which included DNA from digested prey and the whales, and used BLAST searches against the GenBank database to identify clones. Of the 72 clones sequenced from the *M. densirostris* sample, 20 contained whale DNA and 52 contained prey DNA. The 52 prey clones represented 3 unique sequences, which were identified as gulper eel (*Eurypharynx pelecanooides*; 3 clones) and 2 other ray-finned fish (class *Actinopterygii*; 1 and 48 clones). Although squid are thought to be a main prey of *M. densirostris*, we did not detect them, even though our primers were appropriate for squid DNA and we sequenced enough clones to detect any prey that made up at least 10% of the sample. Our technique offers promise for noninvasively determining diets of free-ranging marine mammals and facilitating improved understanding of their foraging ecology.