Environmental DNA from lake water is effective at detecting elusive geese and other waterfowl species

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Abstract

For many aquatic and semiaquatic mammal, amphibian and fish species, environmental DNA (eDNA) methods are employed to detect species distribution and to monitor their presence, but eDNA is much less employed for avian species. Here, we developed primers for the detection of true geese and swan species using eDNA and optimized a PCR protocol for eDNA. We selected taiga bean goose (*Anser fabalis fabalis*) as our focal (sub)species and sampled water from lakes, from which the presence of taiga bean goose was visually confirmed. We filtered the lake water and extracted eDNA. We also included field negative controls (sterile water) which were handled similarly as eDNA samples to control sterility of equipment. For testing if taiga bean goose DNA could be detected among DNA of other goose species, we similarly sampled eDNA from a zoo pond housing several Anatidae species. We were able to detect taiga bean goose DNA in all but one of the tested lakes, including the zoo pond. The primers developed are not species-specific, but rather specific for the genus Anser, due to close relatedness of *Anser* species. We also developed eDNA primers for *Branta*-species and *Cygnus*-species and tested these primers using the same samples. Canada goose (*B. canadensis*) and barnacle goose (*B. leucopsis*) DNA were only detected in the zoo pond (in which they were present), as the sampled natural lakes fall outside the range of these species. We detected whooper swan (*C. cygnus*) DNA in three lakes and the zoo pond (in which the species was present). The eDNA method presented here provides a potential means to monitor elusive goose species and to study the co-occurrence of large waterfowl.

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