A self-preserving, partially biodegradable eDNA filter

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Video Abstract

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Abstract

EnvironmentalDNA capture is helping researchers do the seemingly impossible: track the numerous plants and animals that call natural waters home. But fishing for so-called eDNA can be precarious work. Each step of the process, from water sampling to DNA detection, is a point of entry for contaminants or of loss for sample material. Now, a new standard could be in the making. Self-preserving and partially biodegradable, this new filtration system eliminates data-compromising steps from eDNA capture while ensuring long-term sample preservation and generating less plastic waste. In standard eDNA collection, a motorized or hand-powered pump is used to force a water sample through a DNA-capturing membrane. The filter housing is then opened and, using sterilized forceps, the membrane is carefully transferred to a vial. Finally, ethanol is added to preserve the captured eDNA while its transported to a lab for sequencing or PCR detection. While proven effective, this method is vulnerable to mishandling that could affect the results of eDNA analysis—especially during filter transfer. The new protocol eliminates this step entirely. Instead of chemical preservation, the method relies on desiccation to keep eDNA intact. That's made possible by a hydrophilic filter housing that rapidly dries the encapsulated filter membrane—making eDNA preservation automatic and membrane handling unnecessary. The new material is also biodegradable, thereby contributing to less plastic waste production than in the conventional sampling approach. Tests in the lab and the field showed that both ethanol and the desiccating filter housings could effectively preserve eDNA for 6 months—with the self-preserved filters performing a bitbetter. The self-preserving system yielded slightly more target DNA on average under controlled conditions, and up to twice as much eDNA per liter in the field. These differences could be due to the loss of captured eDNA to the ethanol preservative when the filter is removed for processing. Or due to the different filtration dynamics of the two filter housing materials. Overall, the results indicate that the new eDNA collection system is a viable alternative to standard ethanol preservation methods. With an increasing number of non-experts making important scientific contributions in the field, that's crucial. Simple, easy-to-use, and waste-reducing,the system could be a welcome addition to any researcher's toolkit. Currently, researchers are exploring different materials options that could make the entire setup biodegradable. And ongoing field tests could reveal the benefits for other systems and for more complex applications, such as eDNA metabarcoding.