Remote health assessment of whales using small rotary UAS: inference from case photographs and breath sampling

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Photogrammetry from aerial images is an established approach for collecting morphometric measurements of free-swimming whales and this method has been made more accessible and affordable by the development of small rotary UAS platforms. These small, remote controlled aircraft can hover a camera over whales at lower altitudes without disturbing them, resulting in significant increases in photographic efficiency and quality. We describe how these high quality images can be useful for making inference about whale health, beyond simply providing data on morphology. Specifically we present examples from our studies using a small hexacopter (APH-22, Aerial Imaging Solutions) to illustrate how images can be used to assess the severity and incidence of entanglement wounds in North Atlantic right whales, guide entanglement response efforts for killer whales, and document ship-strike wounds on humpback and killer whales. We also describe our use of the hexacopter to collect exhalation samples from large whales, including blue whales, humpback whales and North Atlantic right whales. By descending as low as 6ft (under permit) to fly over the blowhole as the whale exhales, we have now collected dozens of blow samples on sterile collection plates, with no observed behavioral response from the whales. These samples are being genetically analyzed to identify the microbiome community in each whale's respiratory tract, which is a key site of disease in cetaceans. We are combining the results of blow analysis with photogrammetry measurements of condition to compare the health of whales in contrasting environments, ranging from relatively urban to pristine. As upper level consumers and predators in marine food chains, elucidating the health of whale populations can help us to understand the status of important marine ecosystems.