Development of a mass spectrometry method capable of detecting and quantifying a panel of steroid hormones in right whale blow

Quantification of steroid hormones in biological materials (e.g., blubber and feces) is increasingly being used to study stress responses and reproductive patterns in various cetacean. Unfortunately, blood is hard to obtain for free-swimming animals, the collection of feces is largely opportunistic, and baleen can only be obtained from dead animals. Biopsies provide a means to assess skin and blubber hormone levels over longer timeframes, leaving only blow as a possible matrix for assessing hormones over shorter timeframes. This is important when attempting, for example, to isolate the stress responses to acute noise events. Attempts to quantify blow hormones to date use off-the-shelf immunoassay-based kits, which have relatively high detection thresholds that require a certain amount of blow. Given the increasing anthropogenic (noise, entanglement) and environmental (changing prey resources and climate) pressures on critically endangered species such as the North Atlantic right whale, we sought to develop tools to effectively monitor the physiology and health of whales to help advance conservation and mitigation strategies. To address many of the existing laboratory limitations, we developed and validated extraction methods together with a liquid chromatography-tandem mass spectrometry (LC-MS/MS) method to simultaneously measure glucocorticoids (cortisol and corticosterone) and the reproductive hormone, progesterone. This was done initially for blow collected from a Pacific white-sided dolphin at Vancouver Aquarium before being applied to samples from right whales. Other potentially stress-related steroid hormones were also monitored. To increase the amount of material collected, an existing drone-based design was adapted, placing a servo-mounted petri-dish on a custom built high-speed racing drone. This was piloted through the blow of individuals multiple times in a surfacing bout by a world-class racing pilot using first person view technology. Together, these approaches elevate blow collection as a promising tool for the non-invasive, systematic study of stress responses and reproduction in large cetaceans.

A method for acquiring, extracting and quantifying stress and reproductive hormones in whale blow was created involving world-class drone racers and liquid chromatography-tandem mass spectrometry to maximise blow amount and minimise detection thresholds.

Dolphin blow collectors:

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