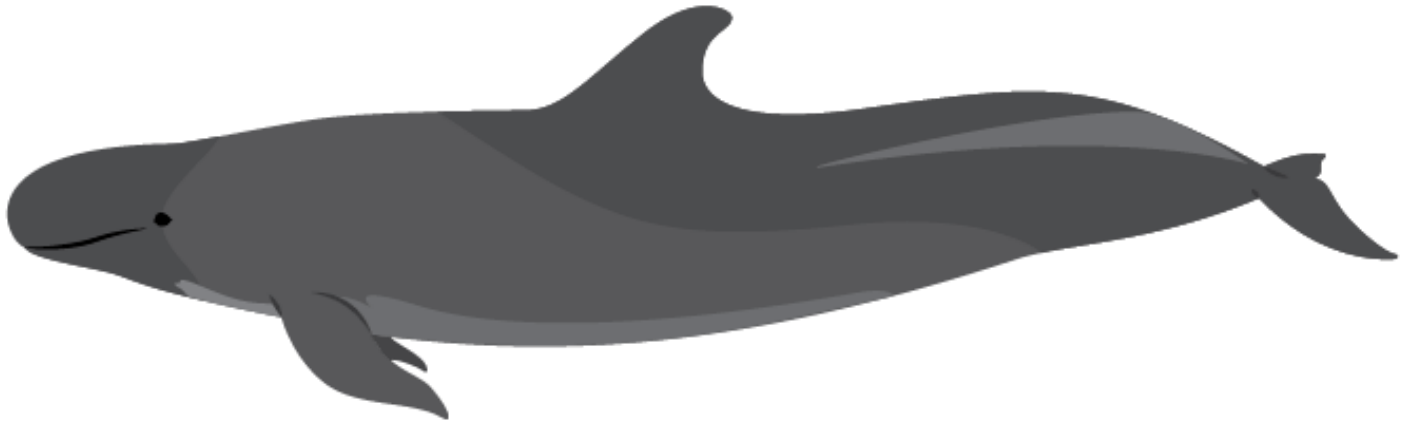
How Drones Reveal the Health of Hawai‘i’s Rarest Whales

Around the Hawaiian Islands lives a small group of toothed whales called false killer whales. They are endangered, and only about 139 are left. To find out how healthy they are, we flew drones over them and measured their bodies from the sky. We learned that some whale groups are in better shape than others, and that one year stood out as the worst: 2020, when the ocean was unusually hot. A few whales even lost a quarter of their body weight, over 500 pounds, in just a couple of months. By watching how a whale weight or “body condition” changes over time, we can spot trouble early and help protect these whales before it is too late.



A false killer whale, the species in this study. Despite the name, it is really a large dolphin. Adults can grow longer than a small car.

WHAT ARE FALSE KILLER WHALES?

False killer whales are not actually killer whales. They are a kind of large dolphin with a long, slim body and a rounded head. They got their name because their skulls look a little like a killer whale’s skull. Adults can grow longer than a small car and weigh as much as a grand piano.

These whales are smart and social. They travel in tight-knit groups, share food, and stay with the same companions throughout their life. The whales we studied live only around the main Hawaiian Islands. This special group is **endangered**, which means it is at risk of disappearing forever. Only about 139 of them are left [1].

WHY ARE THESE WHALES IN TROUBLE?

For more than ten years, the number of these whales has been slowly dropping. To survive, false killer whales need to catch big, fast fish like yellowfin tuna, mahimahi, and wahoo. The problem is that people fish for those same species. That means the whales and the fishing boats are after the same meals [4].

There is another problem. The fish in Hawaiian waters are getting smaller and fewer. The average mahimahi caught in 2022 weighed about a quarter less than it did many years earlier. When good food is hard to find, a

whale has to work harder and swim farther to eat enough. Hot ocean years can make this even worse by shaking up the whole food web and reducing the amount of food available.

HOW DO YOU WEIGH A WHALE WITHOUT TOUCHING IT?

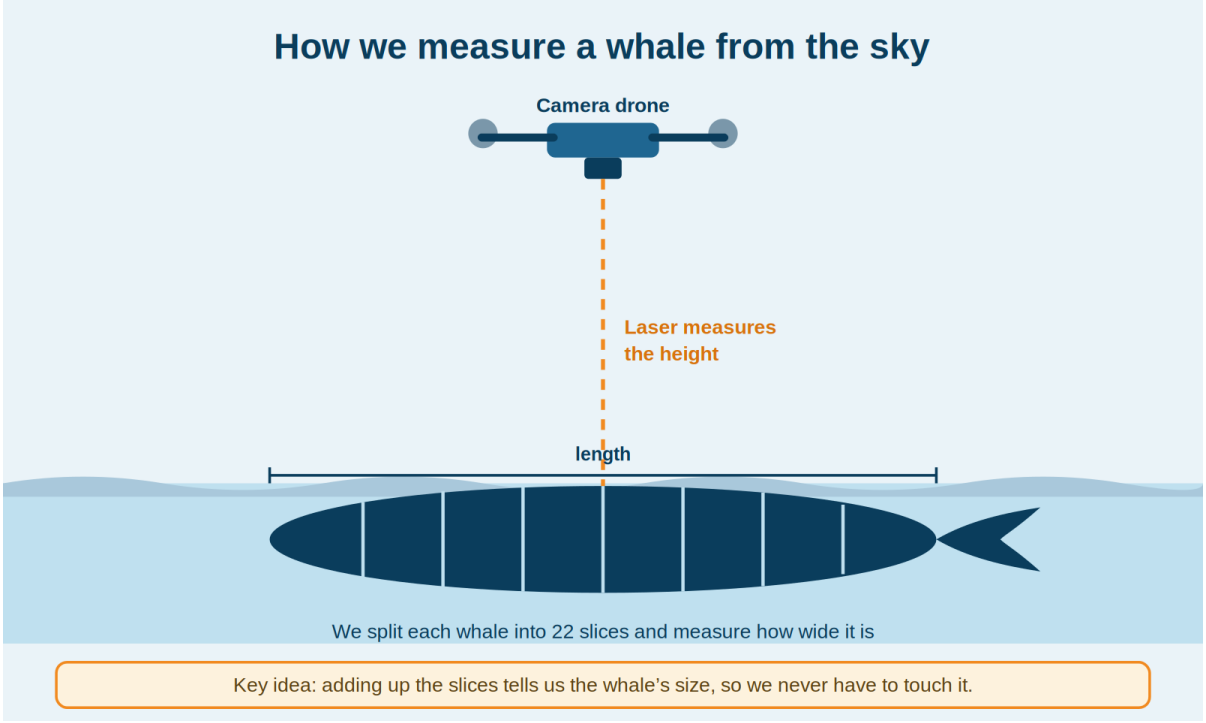
You cannot put a wild whale on a scale. So, we used a flying camera instead. Here is how it works.

Flying the drone. We flew a drone with a camera above each whale as it came up to breathe. A small laser on the drone measured exactly how high it was flying. That allowed us turn the photos into real-life measurements.

Measuring the body. From the photos, we measured how long each whale was and how wide it was at many points along its body. We split each whale into 22 slices, like a loaf of bread, and added up the slices to estimate its whole **body volume** (how much space its body takes up).

Checking our work. To make sure our drone measurements were correct, we compared them to real 3D scans of false killer whales living in an aquarium in Japan. Our drone estimates came within 3% of the real measurements. That told us the method really works.

Once we knew a whale's size, we could figure out its **body condition**: whether it was plump and healthy or thinner than expected for its length.

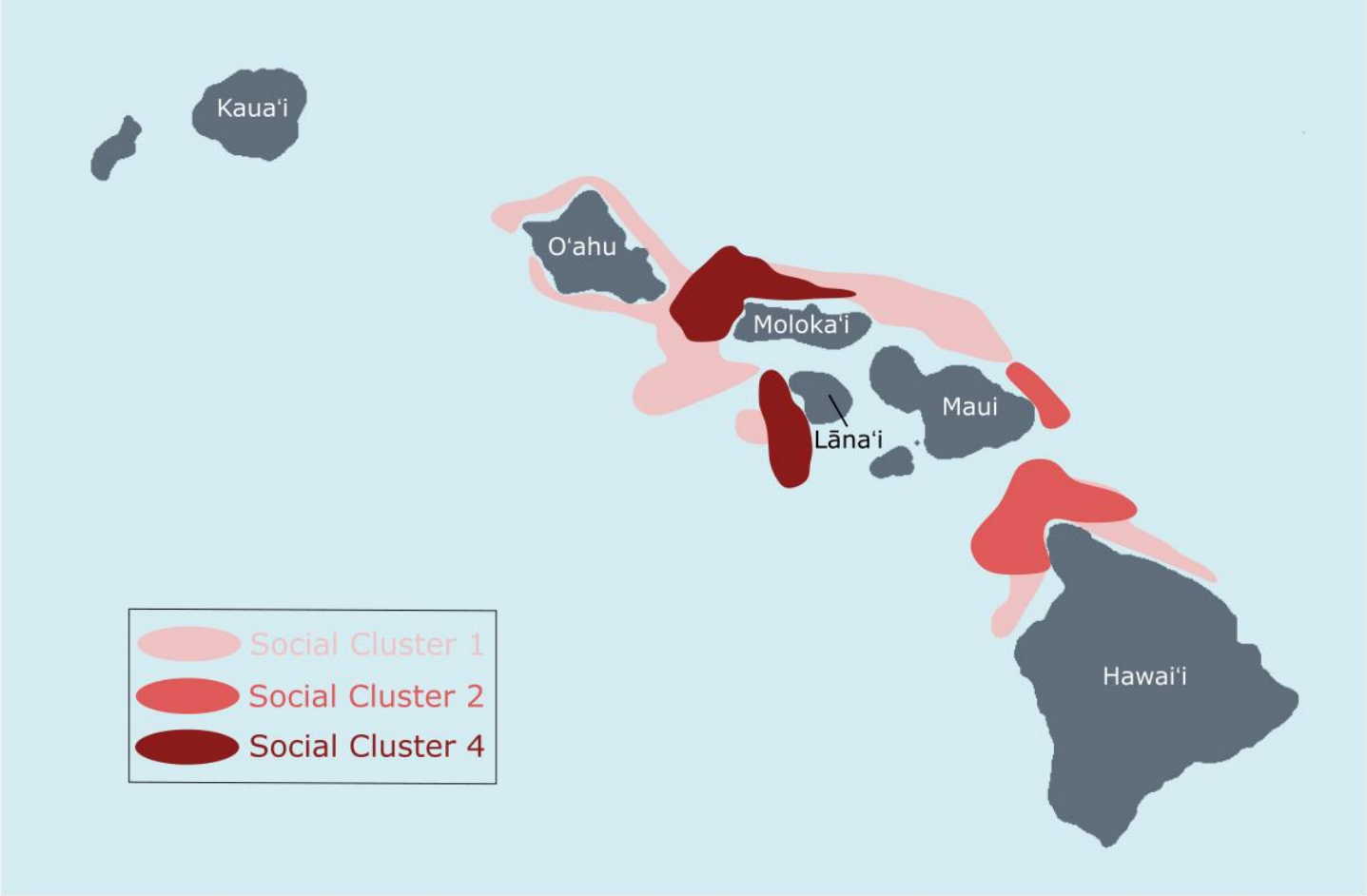


We measure each whale from a drone. A laser tells us how high the drone is, and we measure the whale's length and width to estimate its size.

SOME GROUPS, AND ONE BAD YEAR, STOOD OUT

Between 2019 and 2025 we measured 68 different whales. Two clear patterns jumped out.

First, body condition was not the same for every group. These whales live in long-lasting groups called **social clusters**, and each cluster spends time in different parts of the islands [2]. Two of the clusters tended to be in better shape, while another cluster looked leaner. Where a whale lives, and how far it has to travel for food, seems to matter for its health.



Each whale group, or social cluster, sticks to its own part of the islands. Some roam over a wide area; others stay in a smaller home range.

Second, one year was clearly hit the hardest: 2020. That year the whales were the thinnest, on average, of any year we studied. It was no coincidence that 2020 followed a **marine heatwave**, a long stretch of unusually warm ocean water that raised temperatures across the North Pacific [3]. The same year also brought the single biggest drop in the whale population in five years.

The whales were leanest in 2020, the same year a marine heatwave warmed the ocean and the population fell the most.

We even followed a few whales over time. One adult lost about 234 kilograms, roughly a quarter of its entire body weight, in only two and a half months. Another stayed thin and showed signs of poor health. A third one lost weight but later bounced back to a healthy size. These ups and downs show how quickly a whale's health can change.

WHY BODY CONDITION IS AN EARLY WARNING

Think of body condition like the fuel gauge in a car. A whale that is running low on "fuel" has less energy for the things that keep a population alive: staying warm, escaping danger, and raising healthy babies. We found that young calves carry the most fat for their size, like a full backpack of snacks from their mothers. That fat helps them survive their first years, so anything that makes mothers go hungry can put calves at risk too.

Because thin whales can be a sign of trouble before the population crashes, tracking body condition gives scientists an early warning. When a whole group gets leaner in a hot year, it tells us the ocean food supply may be running short. That is a clue we can act on while there is still time to help.

WHAT YOU CAN DO

You can also help by choosing seafood that is caught in ways that leave enough big fish in the ocean. The more tuna and mahimahi that remain, the more food there is for Hawai‘i’s rarest whales. These whales have lived in island waters for generations, and with a little help from all of us, they can keep swimming there for generations more.

GLOSSARY

FALSE KILLER WHALE: A large, social member of the dolphin family with a slim body and rounded head; the Hawaiian group is endangered.

ENDANGERED: At serious risk of disappearing from the wild forever.

BODY CONDITION: A measure of how plump and healthy an animal is compared to what is expected for its length.

BODY VOLUME: How much space an animal’s body takes up, used to estimate its weight.

PHOTOGRAMMETRY: Taking measurements of real objects, like a whale, from photographs.

SOCIAL CLUSTER: A group of whales that stay together and share the same general home waters for many years.

MARINE HEATWAVE: A long period when ocean water is much warmer than normal, which can disrupt the food web.

BLUBBER: The thick layer of fat under a whale’s skin that stores energy and keeps it warm.

REFERENCES

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