

Eyes in the sky reveal extent of gray seal recovery

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Satellite imagery and other observation technologies allow scientists to gain accurate estimates more quickly and easily. Credit: Duke University/Google Earth

Using research drones, thermal cameras and free images from Google Earth, two Duke University-led studies confirm that gray seals are making a comeback off the New England and eastern Canadian coasts.

The findings help confirm that seal conservation efforts are working, and that these remote eye-in-the sky technologies make it easier and safer for scientists to study migratory wildlife in remote locations and estimate their numbers accurately.

"Past surveys based on traditional methods of counting, using occupied aircraft to survey seals on beaches, islands and seasonal ice cover, counted about 15,000 seals off the southeastern Massachusetts coast," said David W. Johnston, assistant professor of the practice of marine conservation ecology at Duke's Nicholas School of the Environment.

"Our technology-aided aerial survey, which used Google Earth imagery in conjunction with telemetry data from tagged animals, suggests the number is much larger—between 30,000 and 50,000," Johnston said. "This is a conservation success that should be celebrated."

The higher estimate reflects the fact that seals spend significant time at sea, where they are undetectable by land-based observation and difficult and dangerous to track by boat or aircraft.

Johnston and his colleagues published their peer-reviewed study June 14 in the journal *Bioscience*. They calculated the abundance of [gray seals](#) between 2012 and 2015 by combining Google Earth images with more than 8,000 hours of telemetry data from a small number of tagged seals that showed locations and behaviors.



Snow and ice cover can camouflage seals, making it more difficult for scientists to estimate the animals' populations with accuracy. Credit: Duke University

"Integrating high-resolution imagery and traditional telemetry data allowed us to calculate species abundance in locations where it would have been much more difficult, time-consuming and costly to do otherwise," said Jerry W. Moxley, a postdoctoral researcher at the Monterey Bay Aquarium who led the study while he was a doctoral student at Duke.

The Massachusetts study follows a paper which appeared March 24 in the journal *Scientific Reports* in which researchers used drones equipped with thermal imaging technology to conduct aerial surveys of gray seal populations at breeding colonies on Nova Scotia's Hay Island and Saddle

Island.

"Seal pups are born with a white coat, which makes them hard to see against ice or snow using traditional imagery," said Alex Seymour, a geographic information systems analyst at Duke's Marine Robotics and Remote Sensing Center, who led the study. "But they can't hide from thermal imagery."

The images collected by the drones were analyzed using two methods. By the traditional method, scientists slowly and painstakingly counted all seals shown in each image and classified each by size and shape to determine how many adults and pups were present.

In the other method, a computer-vision algorithm counted adults and pups based on the temperature, size and shape of their heat signatures.

The automated counts were less than 5 percent different from the human estimates, and proved better at counting seals that are visually difficult to distinguish from the background landscape or obscured by vegetation.

"Computer-based assessments of seal populations such as this hold great promise in terms of accuracy and repeatability," said Johnston. "And when coupled with new population survey approaches using drones or earth-observation imagery, they help us reduce surveying costs and risks, while increasing data quality."

More information: Jerry H. Moxley et al, Google Haul Out: Earth Observation Imagery and Digital Aerial Surveys in Coastal Wildlife Management and Abundance Estimation, *BioScience* (2017). [DOI: 10.1093/biosci/bix059](https://doi.org/10.1093/biosci/bix059)

Provided by Duke University

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