Whale Photogrammetry

Incorporating individual quality into status assessments

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Supporting documents

Durban, Fearnbach, Barrett-Lennard, Perryman, LeRoi. 2015. **Photogrammetry of killer whales using a small hexacopter launched at sea.** Journal of Unmanned Vehicle Systems, dx.doi.org/10.1139/juvs-2015-0020.

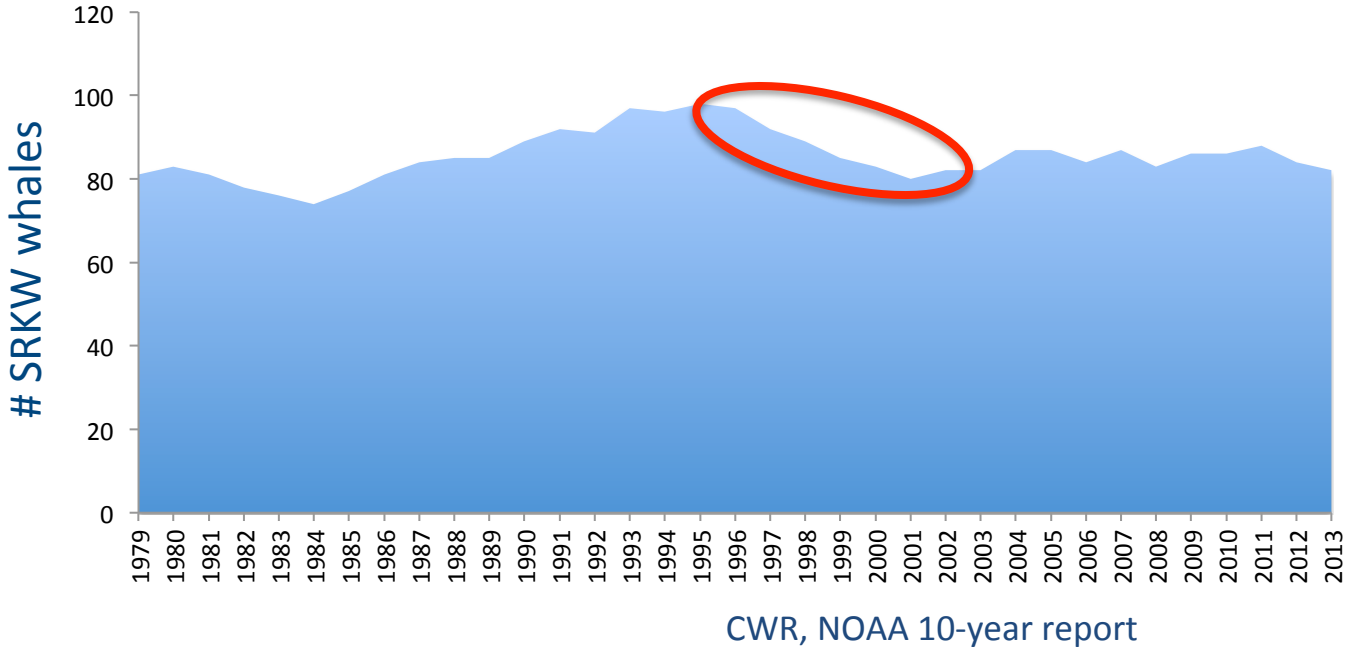
Fearnbach, Durban, Balcomb, Ellifrit. 2015. **Individual-based photogrammetric measures of length, growth and shape to infer body condition and reproductive status of southern resident killer whales**. Contract report to the NMFS SWFSC and NWFSC.

Southern Resident killer whales

Small population (81 whales currently)

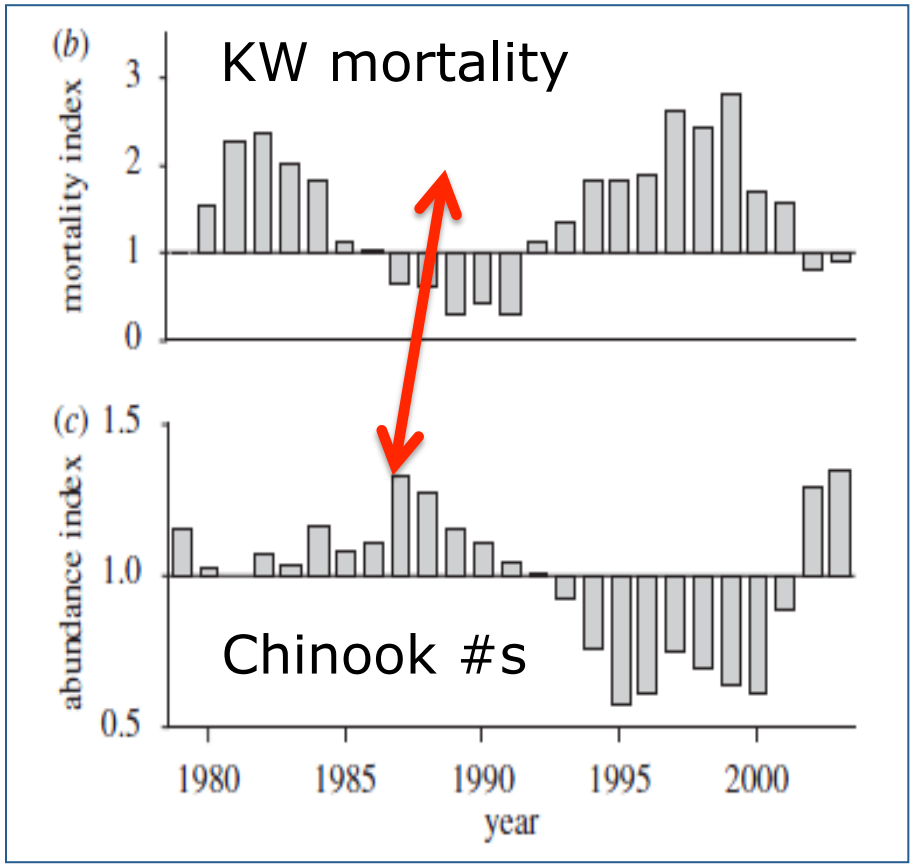
Slow recovery from live captures in ‘60s and ’70s

ESA Listed in 2005, following decline in 1990s



Salmon predators

Whale survival ~ Chinook salmon abundance



Ford et al. 2009. Biology Letters 6: 139-142.

Are there enough fish?

NOAA FISHERIES SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Fisheries and Oceans Canada | Pêches et Océans Canada

July 28, 2011

A Bilateral Scientific Workshop Process to Evaluate Effects of Salmon Fisheries on Southern Resident Killer Whales

Background and context: Southern Resident killer whales (*Orcinus orca*) are listed as an endangered species under both the U.S. Endangered Species Act (ESA) and Canada's Species at Risk Act (SARA). The National Marine Fisheries Service (NOAA Fisheries) and Fisheries and Oceans Canada (DFO) have developed and adopted recovery plans as required by their respective statutes. These recovery plans present the biological status of the population, describe threats and factors believed to be limiting recovery, establish interim recovery objectives and identify critical uncertainties. They prescribe actions to address the threats and limiting factors and call for research to address critical uncertainties and data gaps.

A need for photogrammetry

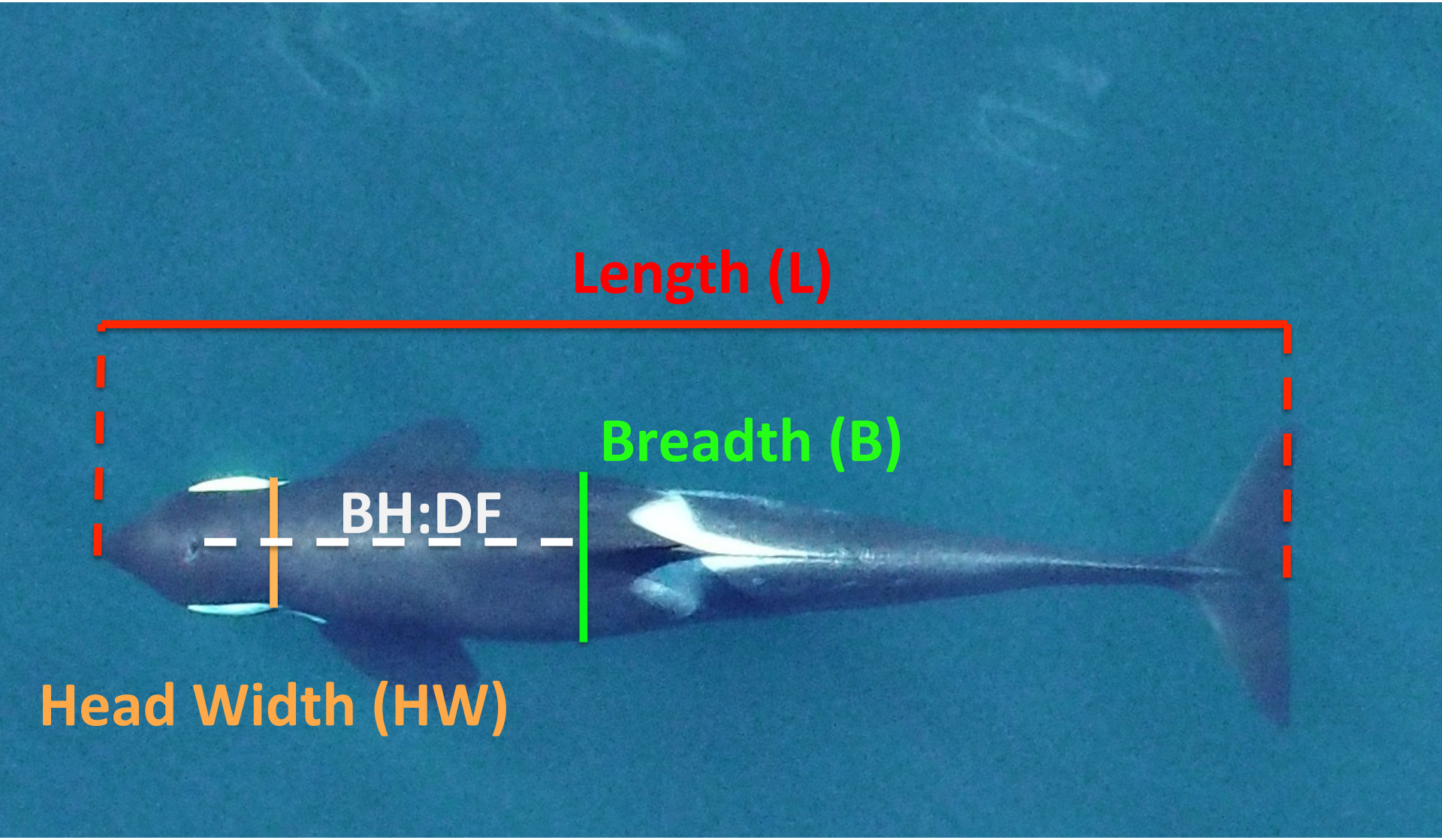
"Overall, the Panel believes that increased use of photogrammetry to monitor seasonal and inter-annual changes in growth and body condition of SRKW is likely to yield the greatest number of new insights into the foraging ecology of SRKW"

Helicopter platform: 2008, 2013

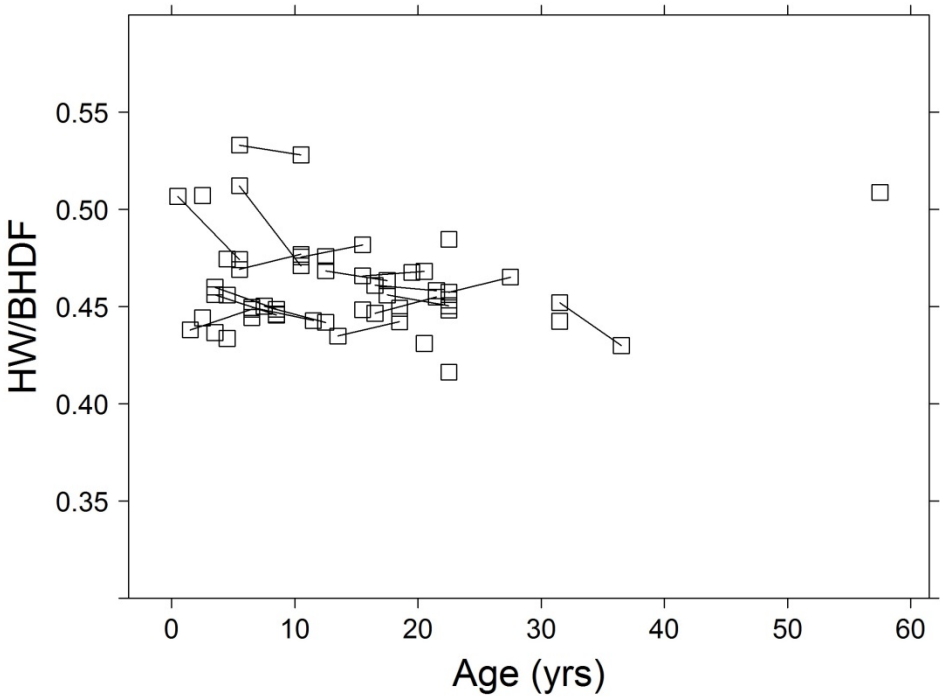
Fearnbach et al. 2011. Endangered Species Research 13: 173-180.

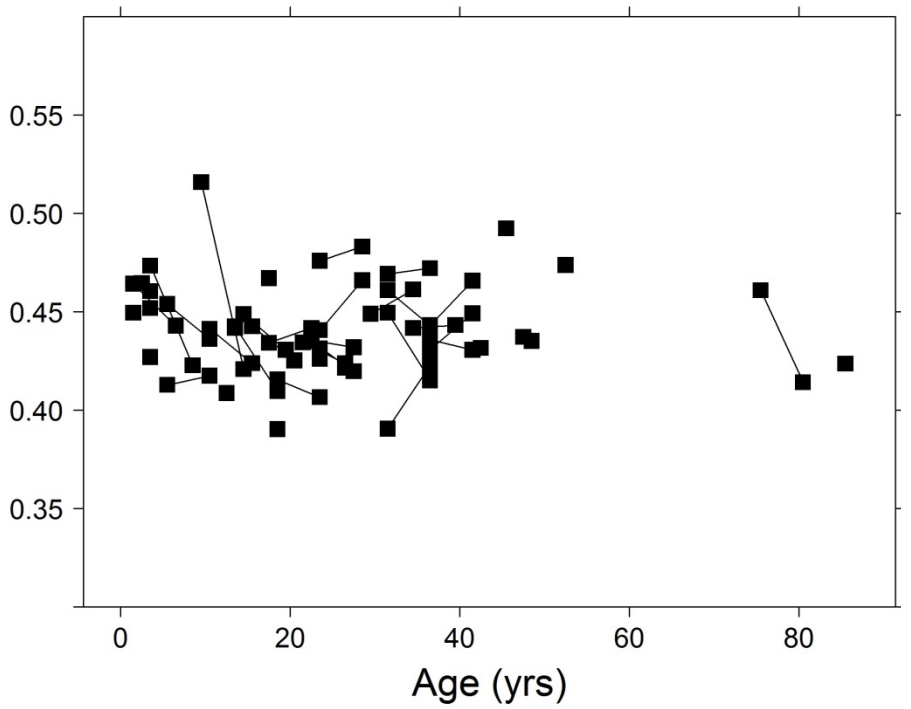
Matching to known individuals

Morphometrics



Head Width, 2008 vs 2013





Males

3 significant changes

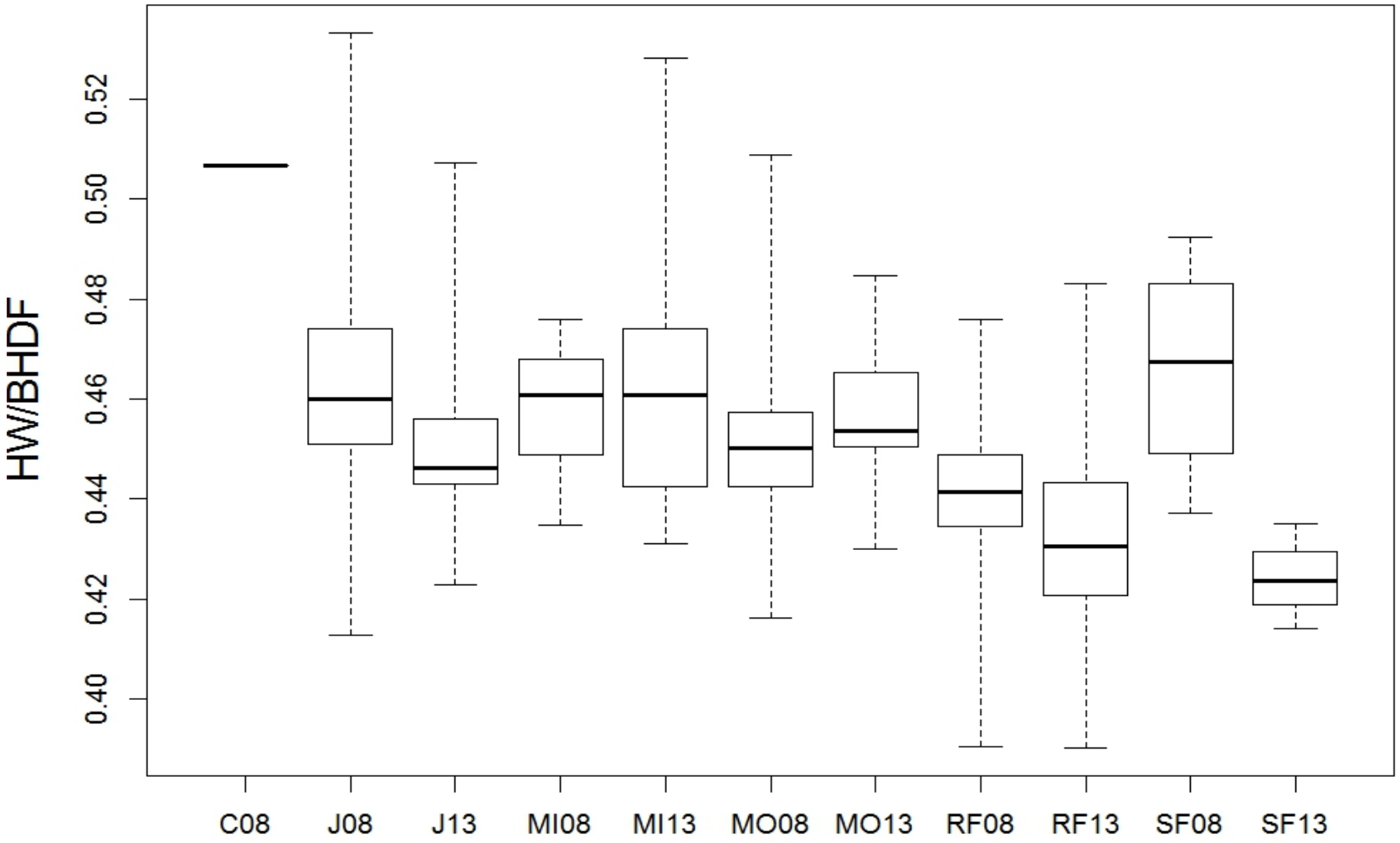
2 decreases in width

Females

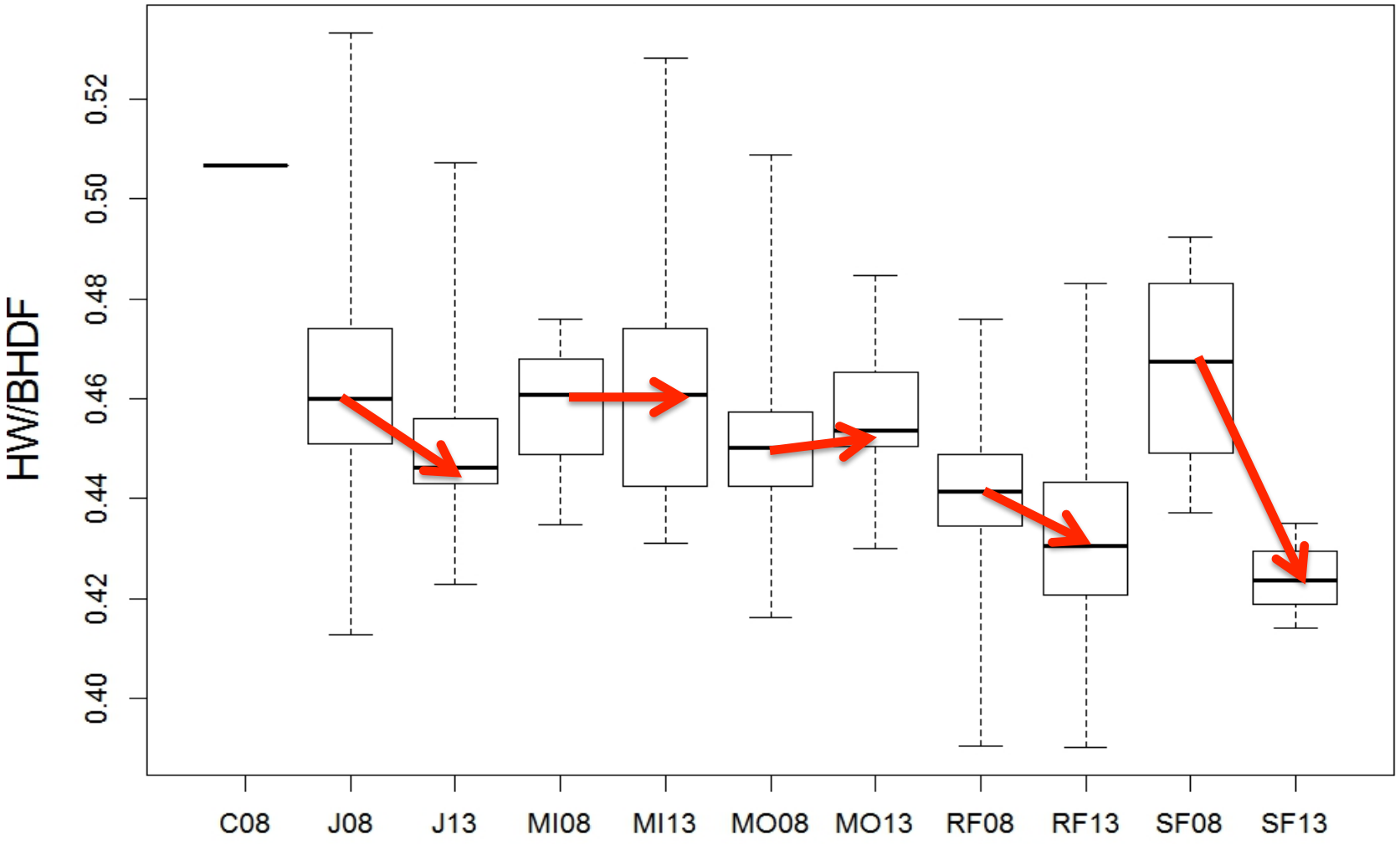
13 significant changes

9 decreases in width

Head Width: age class changes

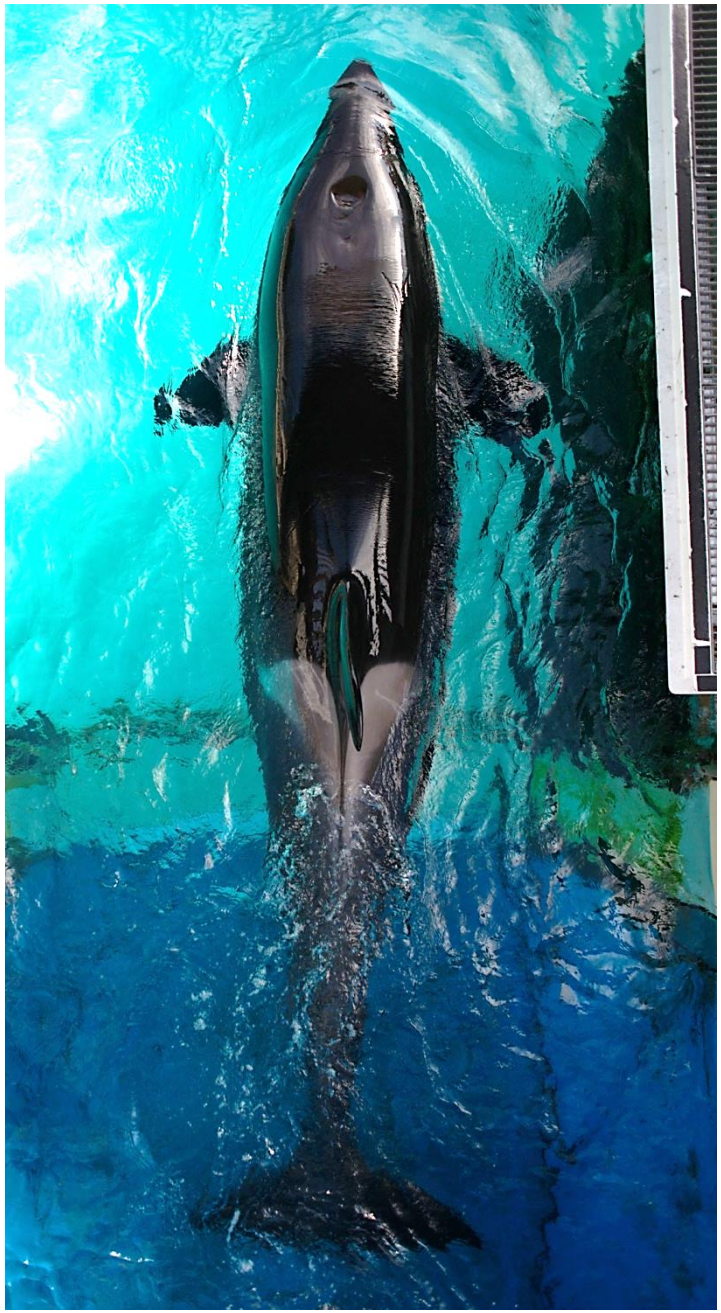


Head Width: age class changes

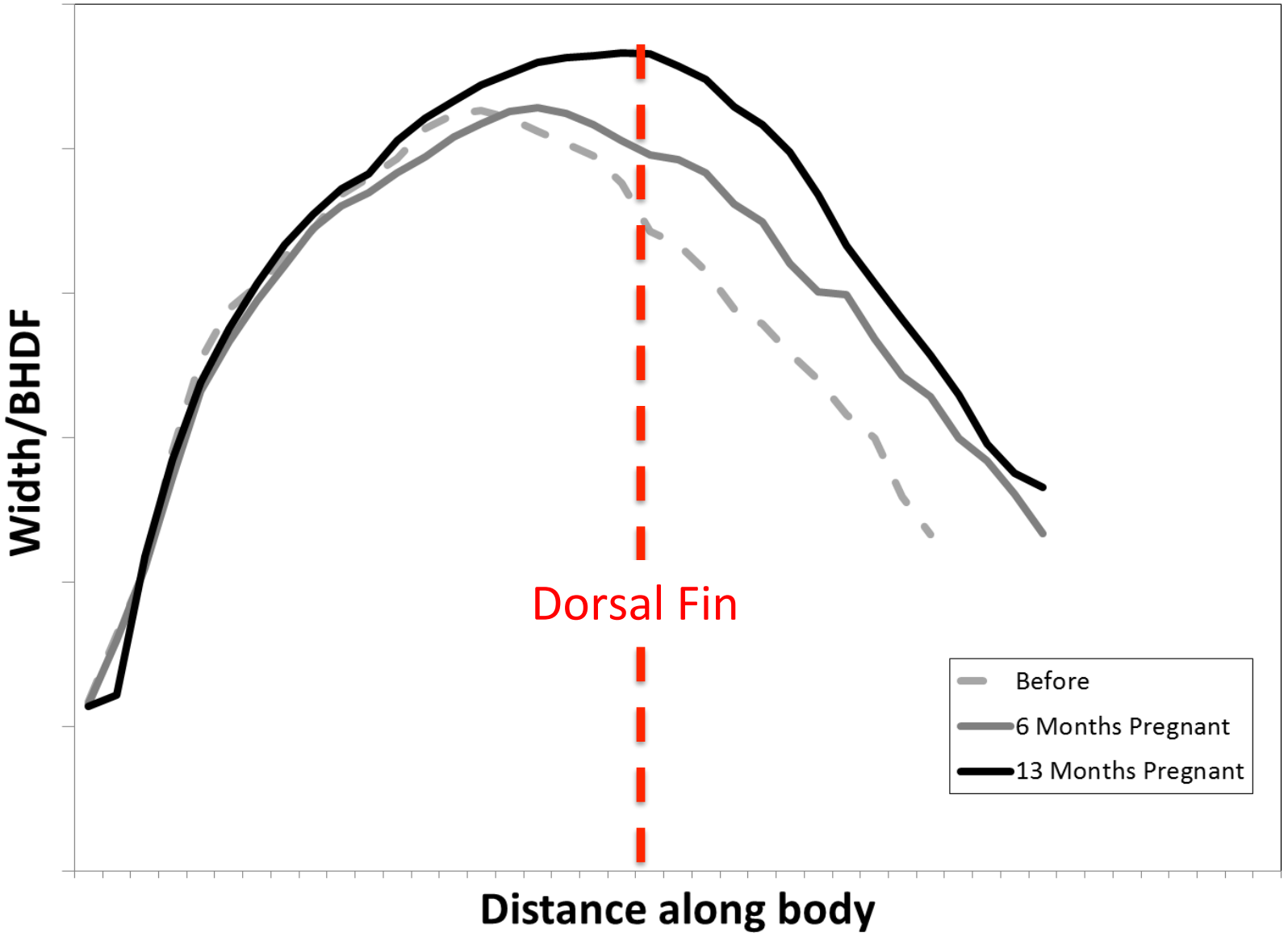


Measuring pregnancy:

SeaWorld, San Diego



Width profiles: Kalia



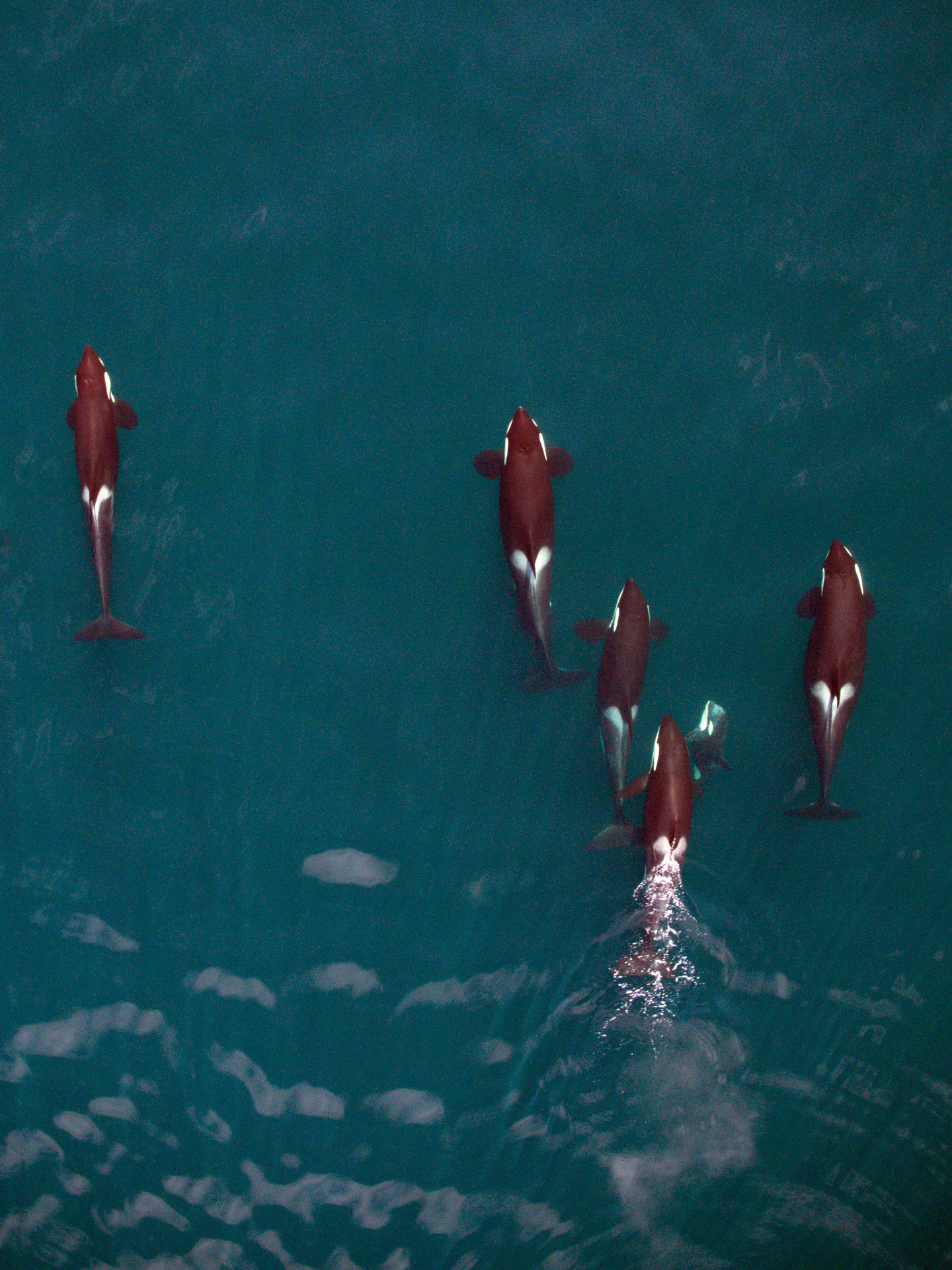
Constrained reproductive success?

Only 2/12 Southern Resident females with wide breadths (inferred pregnant) in 2013 were subsequently documented with a calf.

Hexacopter: more resolution

Durban et al. 2015. Journal of Unmanned Vehicle Systems.

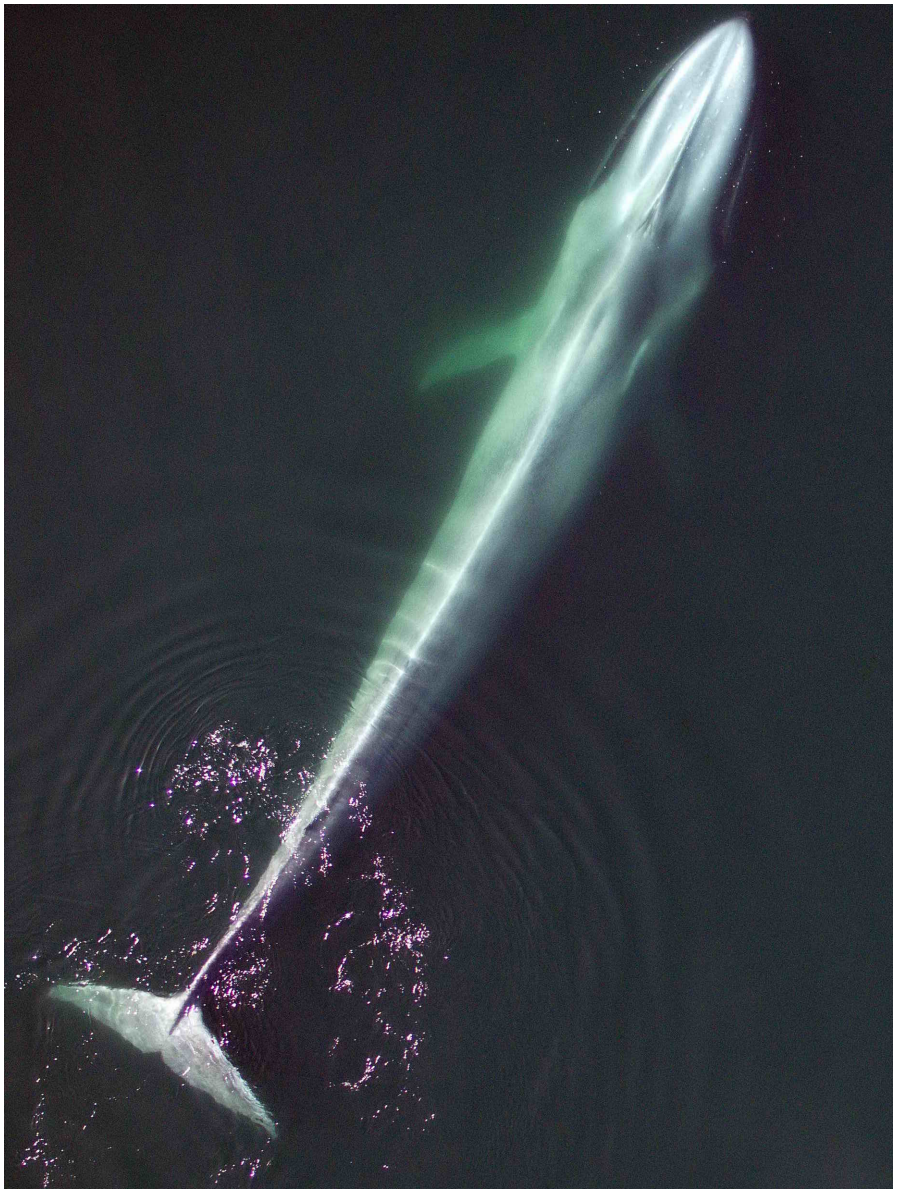
Remote monitoring

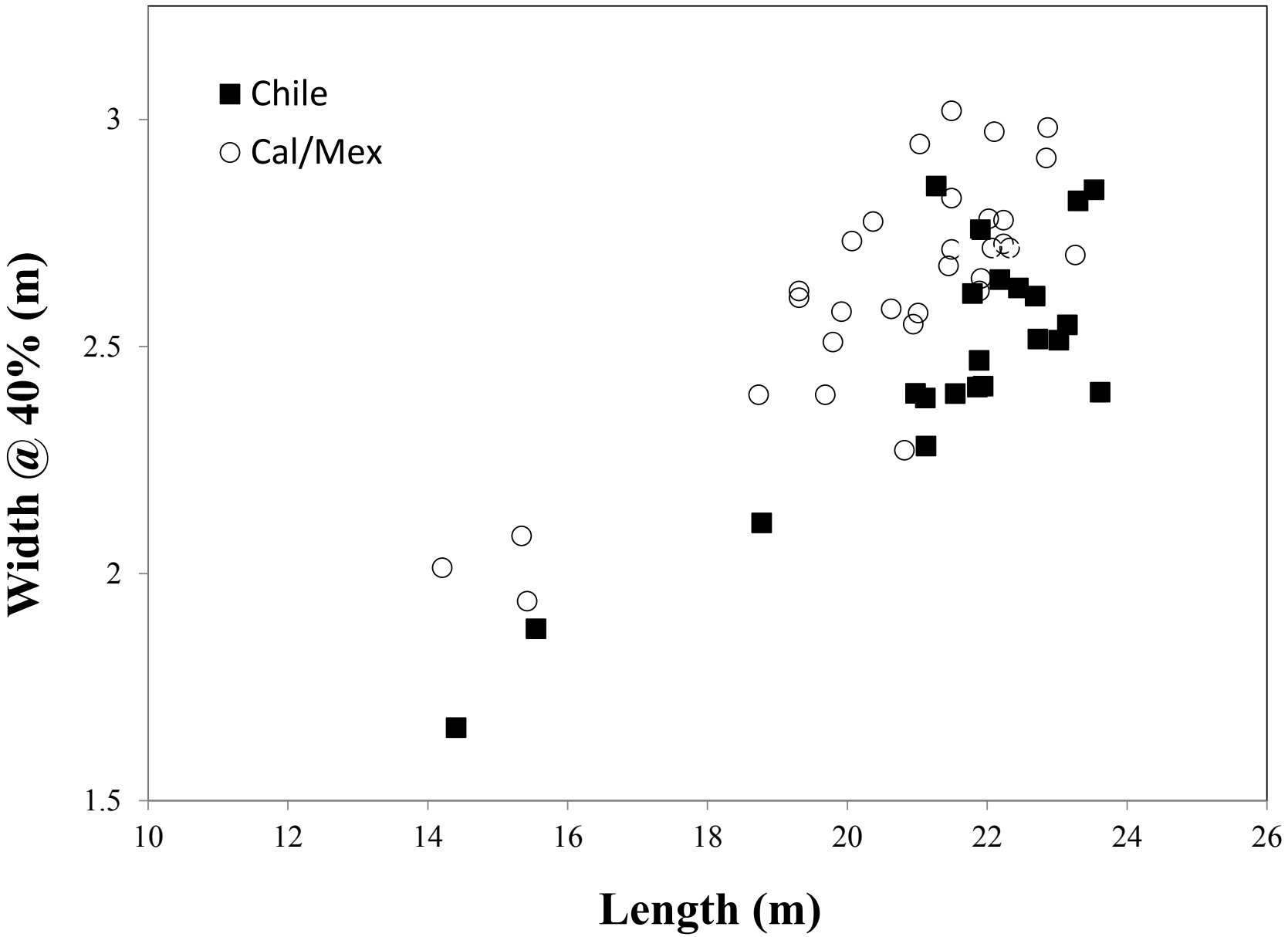


A tool for large whales?

Blue whales off Chile

Comparative condition

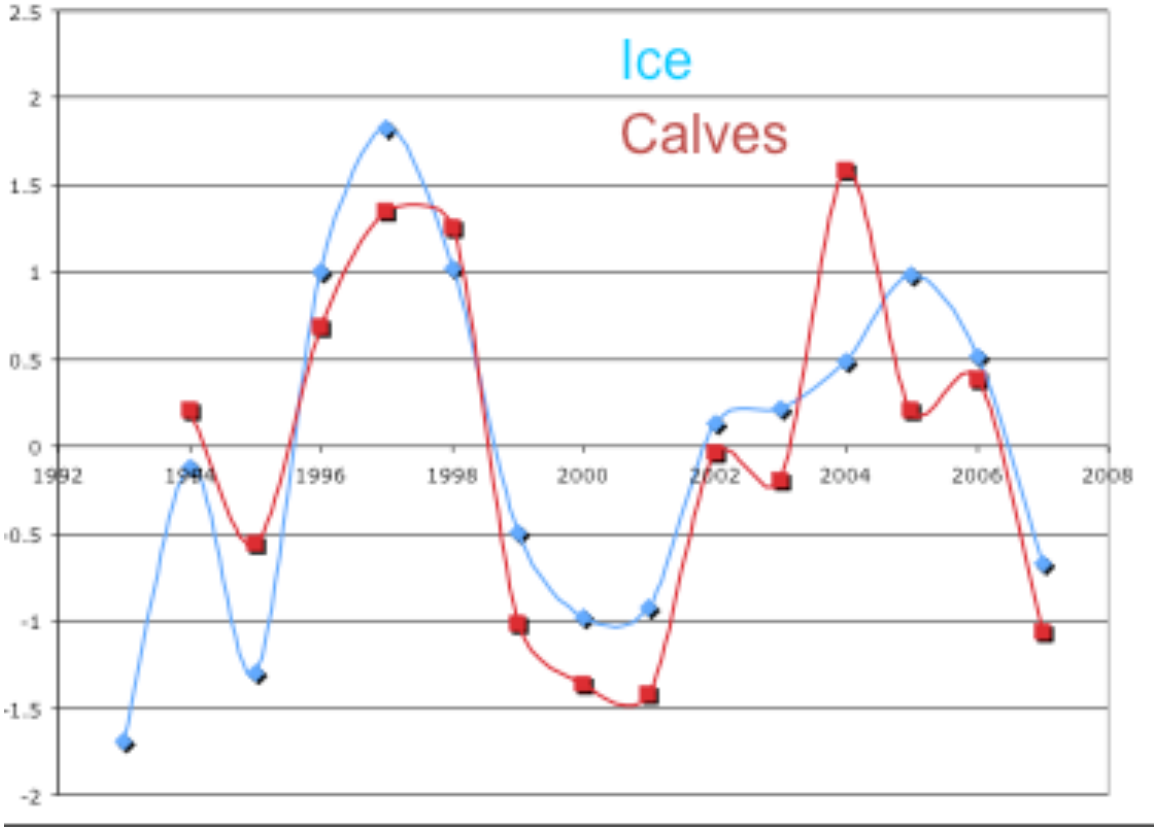




Durban et al. unpublished data

Gray Whales

Using photogrammetry to understand response to environmental change in a recovered population of large whales



Perryman et al. 2002. Marine Mammal Science 18:121-144.

Humpback whales

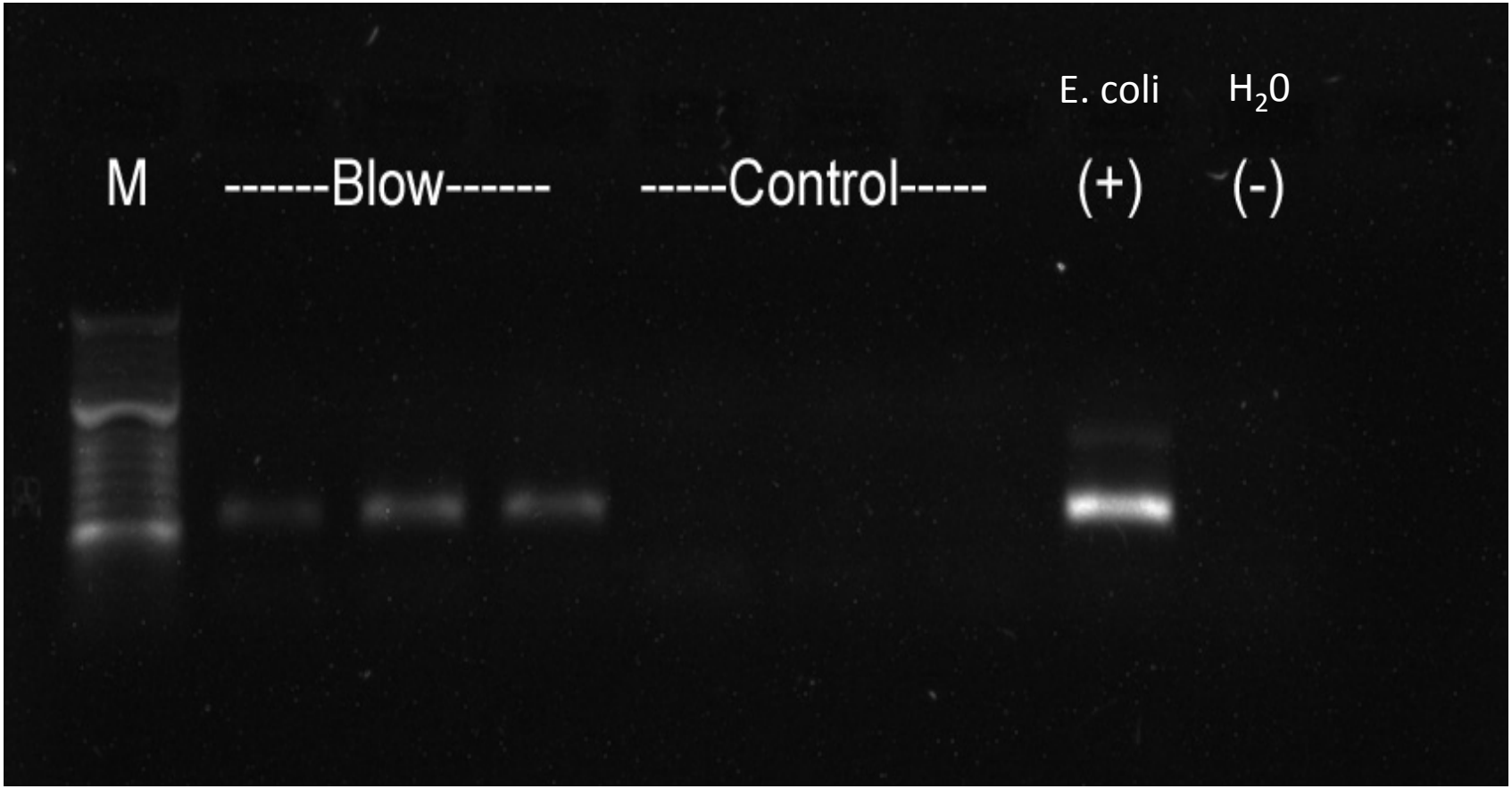
M. Moore et al. unpublished data

Blow sampling

Investigating no only whale condition, but also the causes the causes (19 samples from 36 humpback whales)

Microbiome

PCR identification of respiratory microbiome (blow samples amplify relative to positive E.coli control, e.g. blue whale).



M. Moore et al. unpublished data

Portable and cost-effective