Develop a bioenergetic model for humpback whales by assessing their body condition across their Hawaiian breeding grounds and Alaskan feeding grounds

Aude Pacini

Principal investigators:

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MARINE MAMMAL RESEARCH PROGRAM
UNIVERSITY of HAWAI'I

Alaska Whale FOUNDATION

Collaborators

PACIFIC WHALE FOUNDATION

UNIVERSITY of HAWAI'I HILO

UAF

NATIONAL MARINE SANCTUARIES
HAWAIIAN ISLANDS HUMPBACK WHALE

It takes a village….. Many thanks to all our collaborators

Stephanie Stack and Jens Currie – Pacific Whale Foundation

Adam Pack – University of Hawaii Hilo

Shannon Atkinson, Kelly Cates – University of Alaska Fairbanks

Jan Straley, University of Alaska Southeast

Kristi West – University of Hawaii at Manoa

Also thank you to Oceanwide Science Institute, Ultimate Whale watch, and ARL

In response to anecdotal evidence that sightings of HBW in Hawaii and Alaska have declined in recent years, the Hawaiian Islands Humpback Whale National Marine Sanctuary convened a workshop (Nov 2018).

Workshop participants identified the following priority areas requiring additional research:

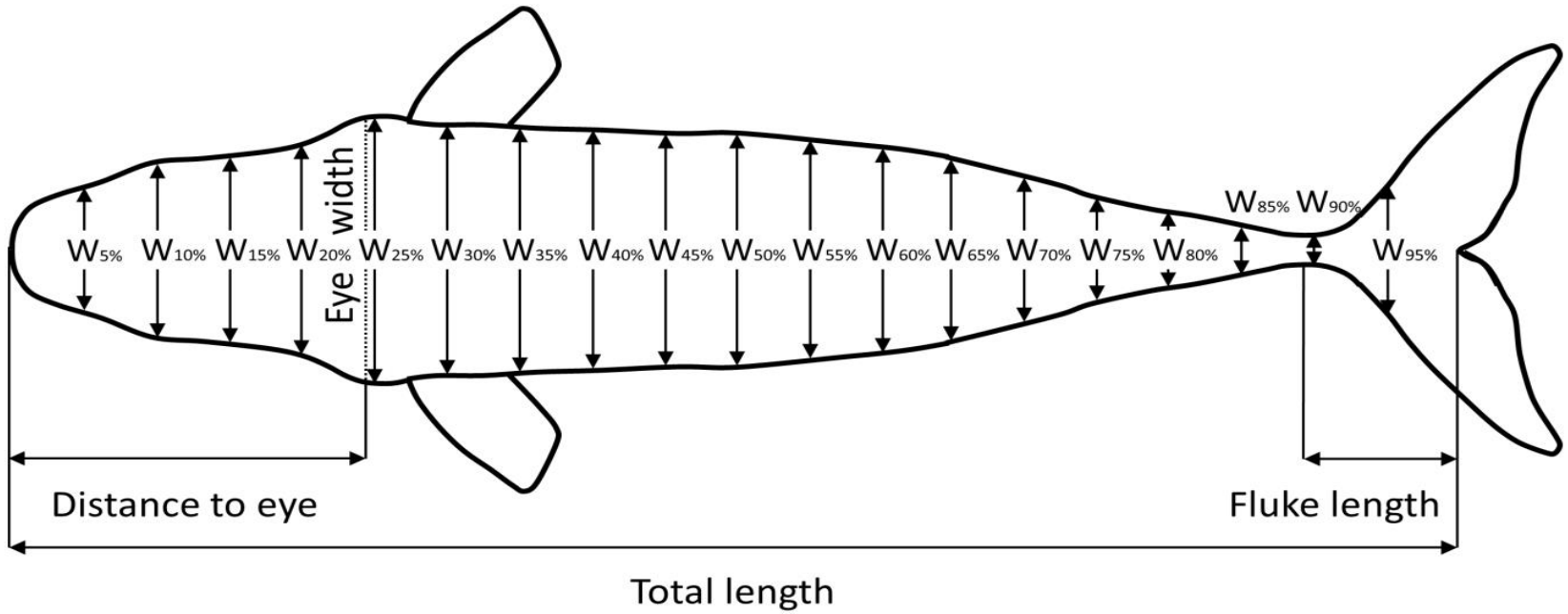
1) Distribution
2) Population health – including body condition
3) Demographics and trends
4) Prey distribution and quality
5) Environmental drivers

Assessing body condition: unoccupied aerial systems (UAS; drones)

Custom-written software

A

B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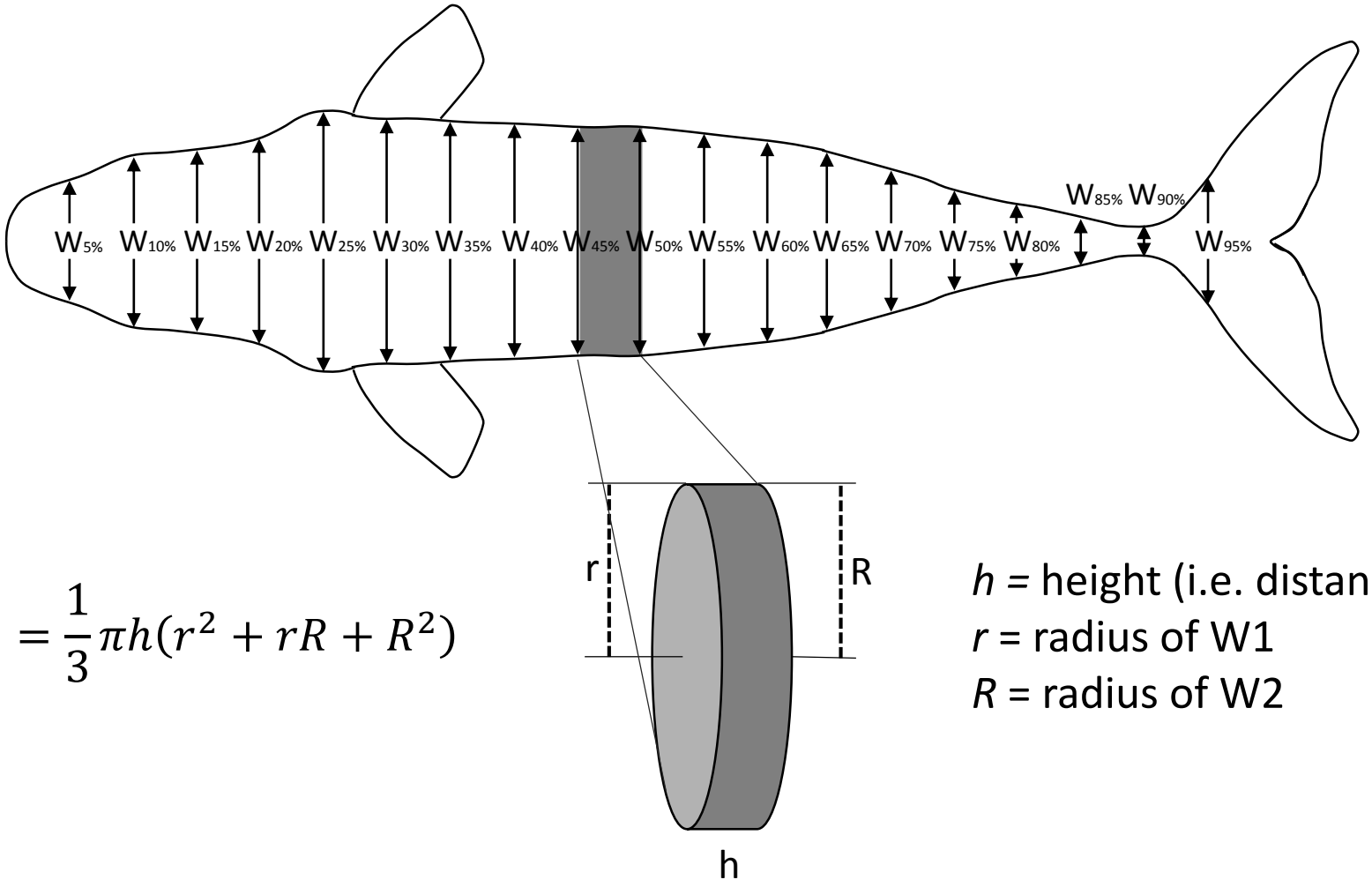
W70%
W75%
W80%
W85%
W90%
W95%
Eye width
Distance to eye
Fluke length
Total length

Calculating body volume



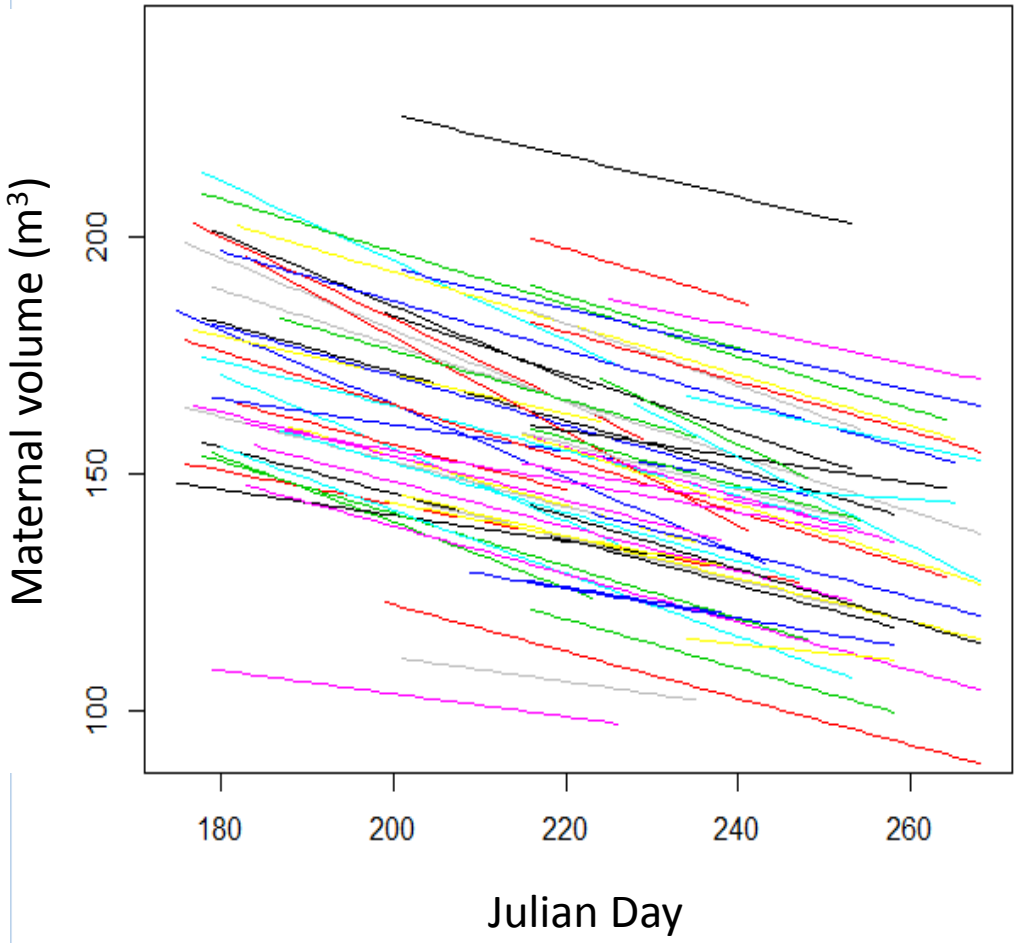
$$V_s = \frac{1}{3}\pi h(r^2 + rR + R^2)$$

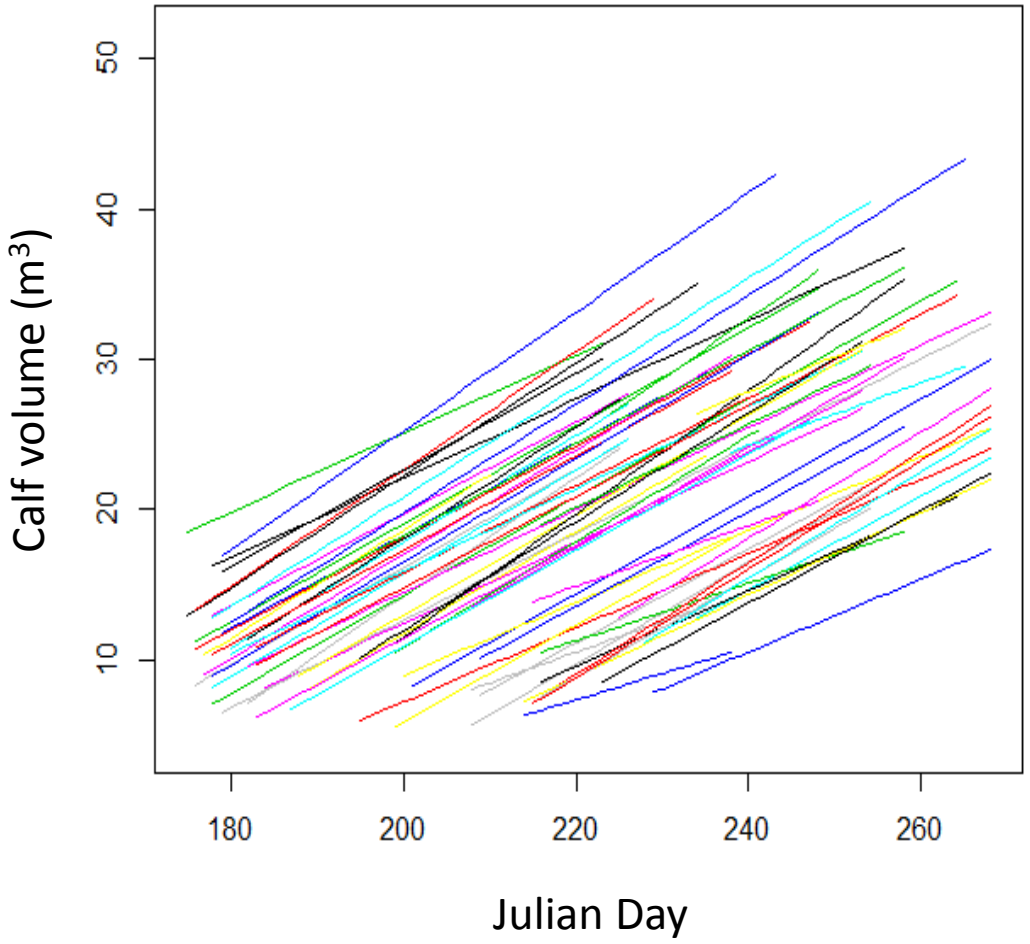
h = height (i.e. distance, m)
r = radius of W1
R = radius of W2

Christiansen *et al.,* 2018. MEPS

Example: changes in condition of southern right whales

Intra-seasonal changes in body condition (southern right whale)





Calves grew, on average, 3.2 cm/day (in length)

Females lost, on average, 25% of their total weight during the 3-month breeding season

Christiansen *et al.*, 2018. MEPS

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How will we accomplish this?

UAS morphometric measurements coupled with simultaneous tissue sampling (chemical analyses)

(in both Alaska & Hawaii)

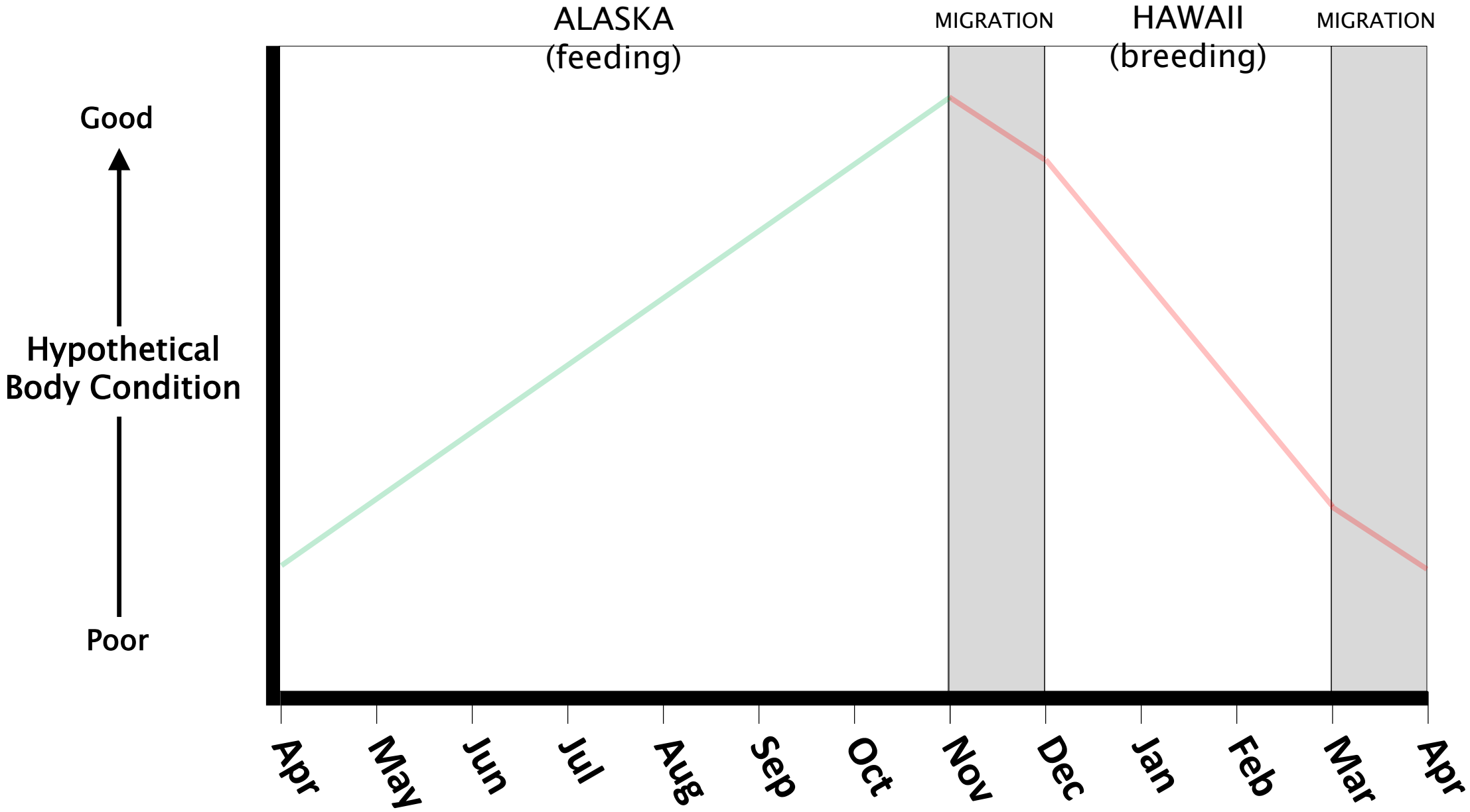
In the following slides:

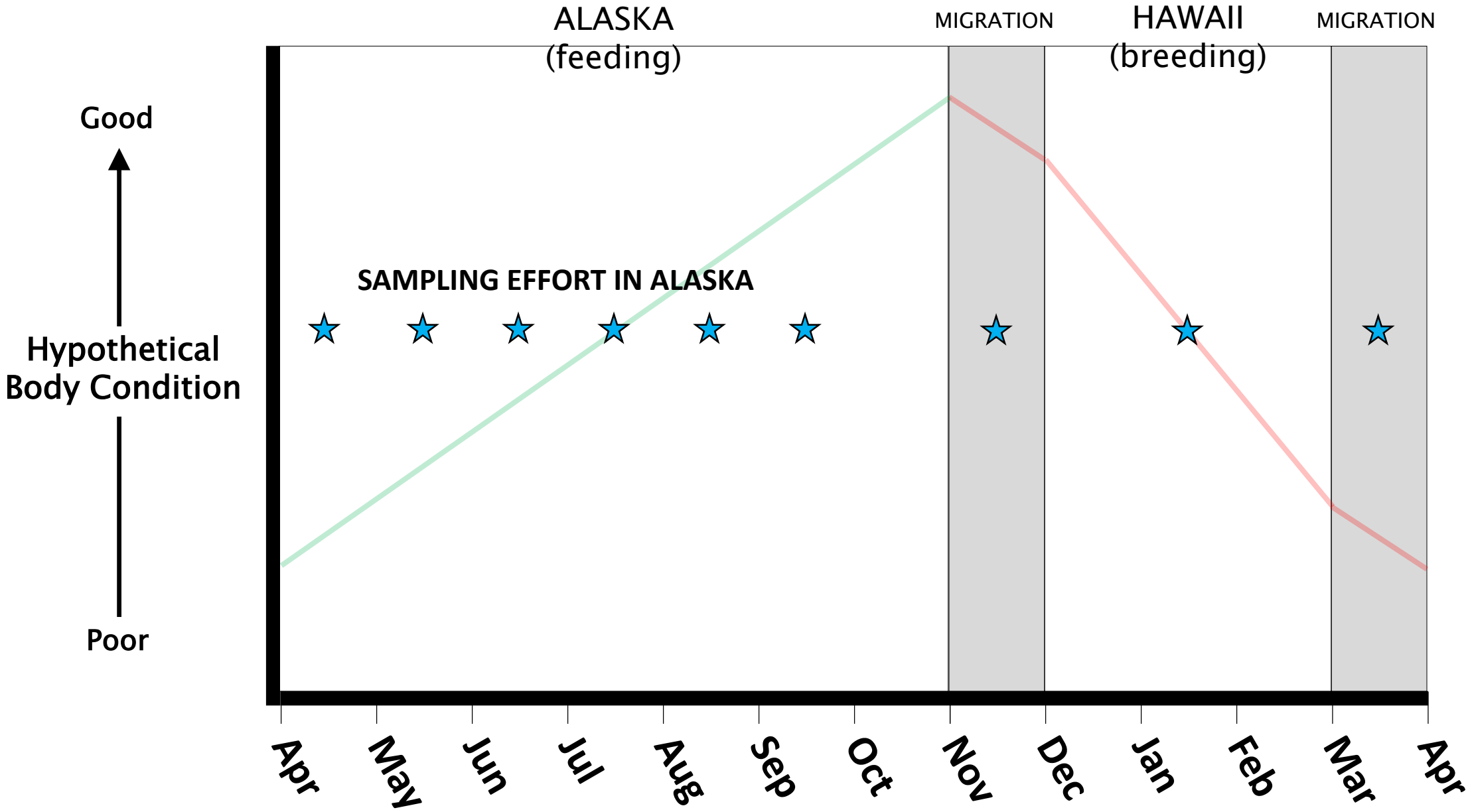
Schematic overview of hypotheses

Overview of sampling regime

Preliminary results

Photo: Christian Miller


ALASKA
(feeding)
MIGRATION
HAWAII
(breeding)
MIGRATION
Good
Hypothetical
Body Condition
Poor
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr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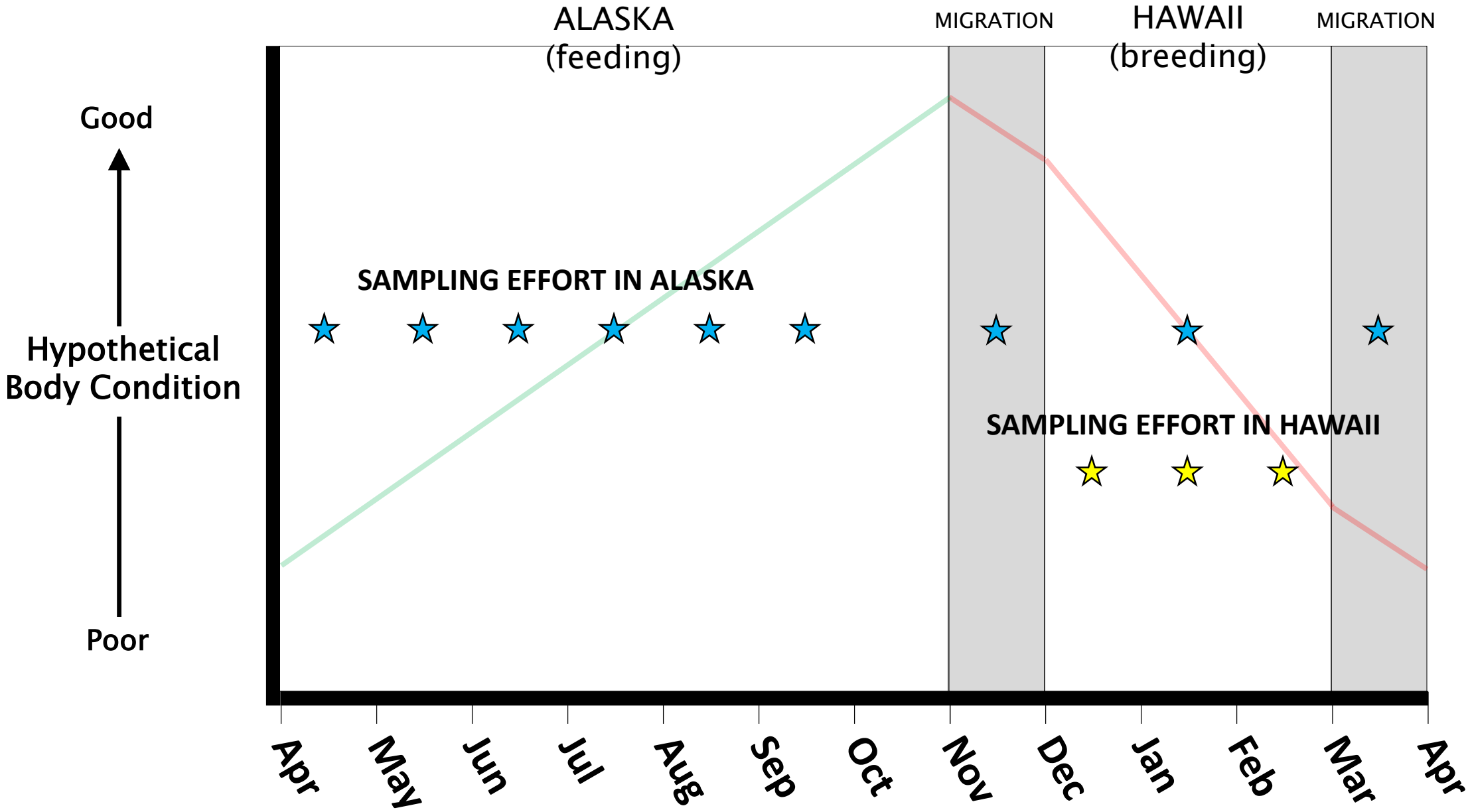
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SAMPLING EFFORT IN HAWAII
Apr
May
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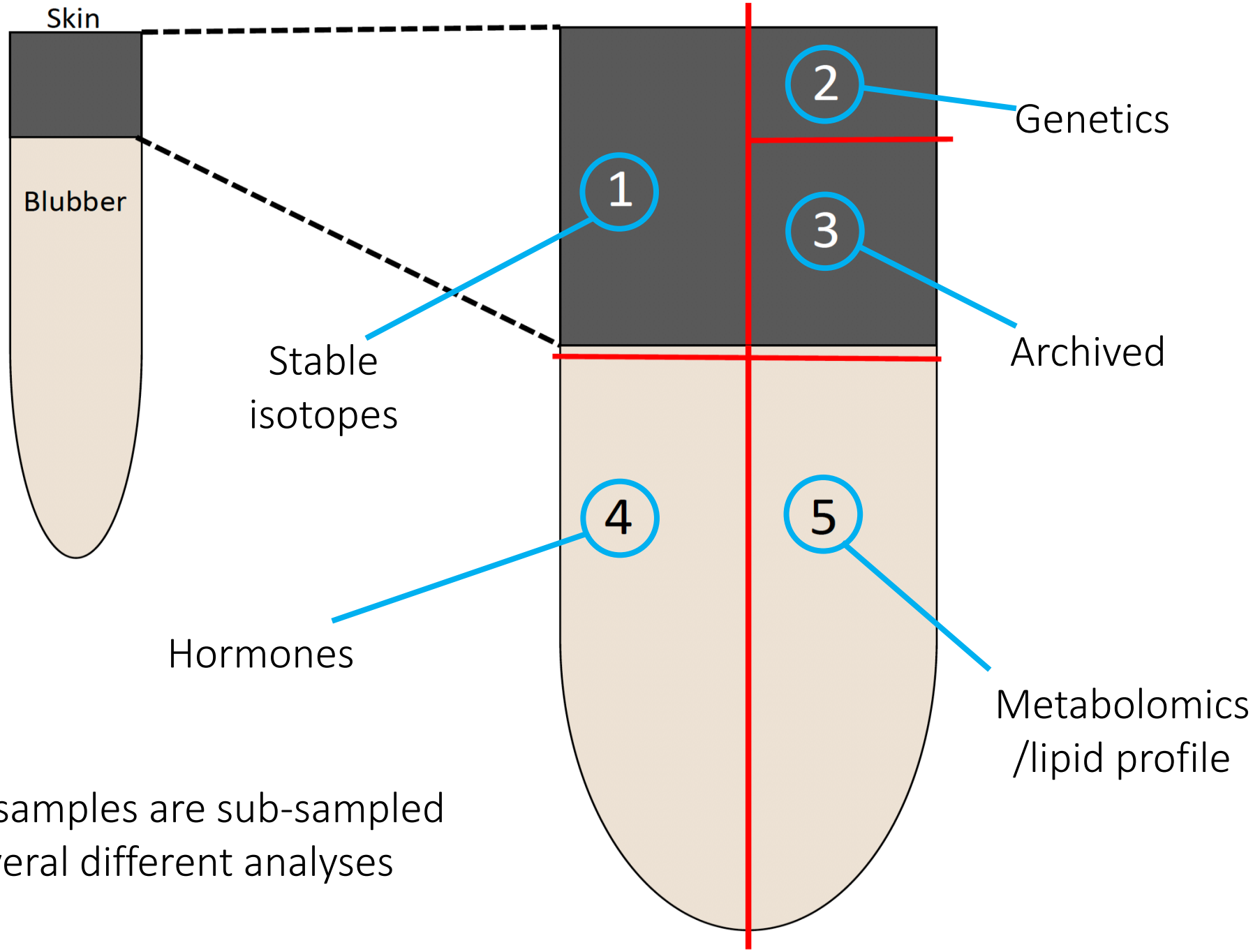
Apr

Tissue sampling of drone-measured animals



Skin and blubber samples are sub-sampled in the field for several different analyses

Off to a strong start… Commenced in 2018

Alaskan feeding grounds

- 2018: July-Aug 2018; Nov 2018
- 2019: Jan, Mar, April
- June-Sept (ongoing)

~500 whales measured

Hawaii breeding grounds

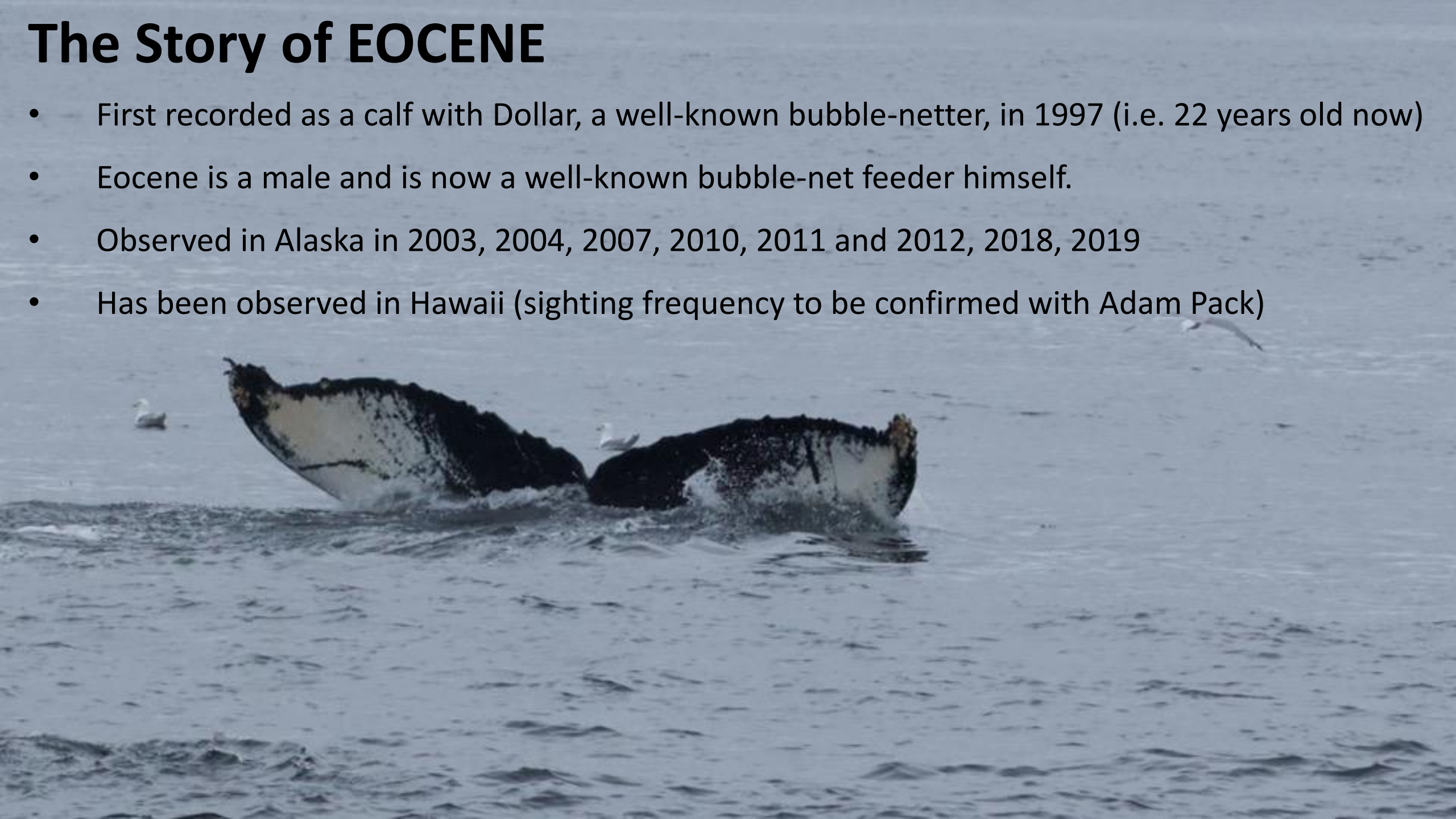
- January and March 2019
- Sample Jan-Feb-March
- Off Maui (main site)

~350 whales measured

PhD candidate Martin van Aswegen – starting shortly

The Story of EOCENE

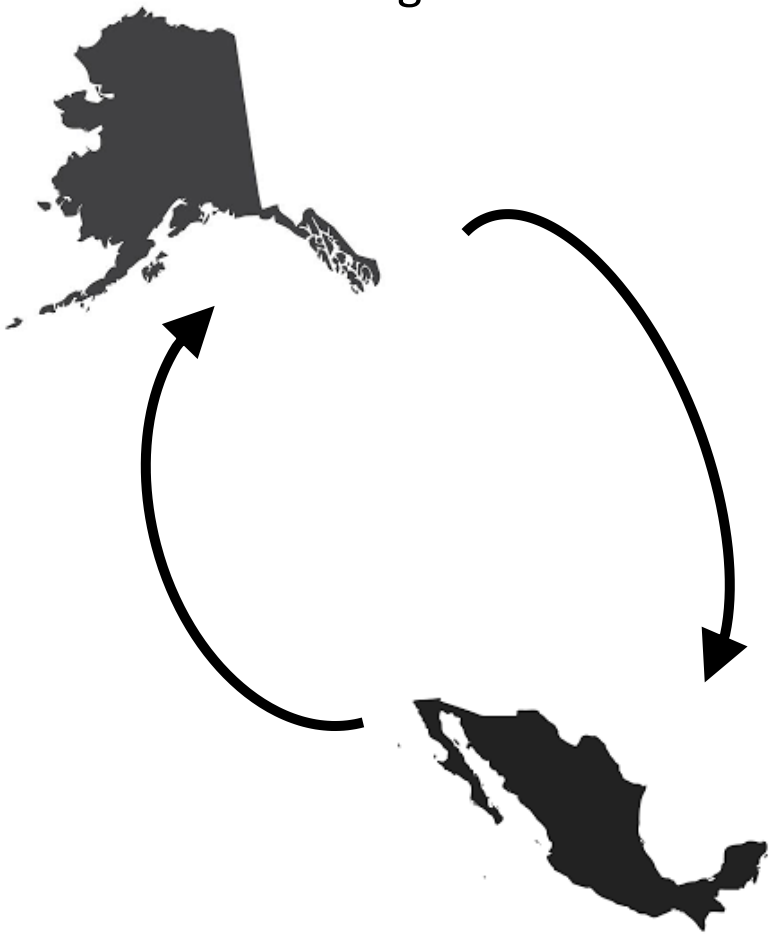
- First recorded as a calf with Dollar, a well-known bubble-netter, in 1997 (i.e. 22 years old now)
- Eocene is a male and is now a well-known bubble-net feeder himself.
- Observed in Alaska in 2003, 2004, 2007, 2010, 2011 and 2012, 2018, 2019
- Has been observed in Hawaii (sighting frequency to be confirmed with Adam Pack)



The story of EOCENE

SE Alaska
Aug 2018

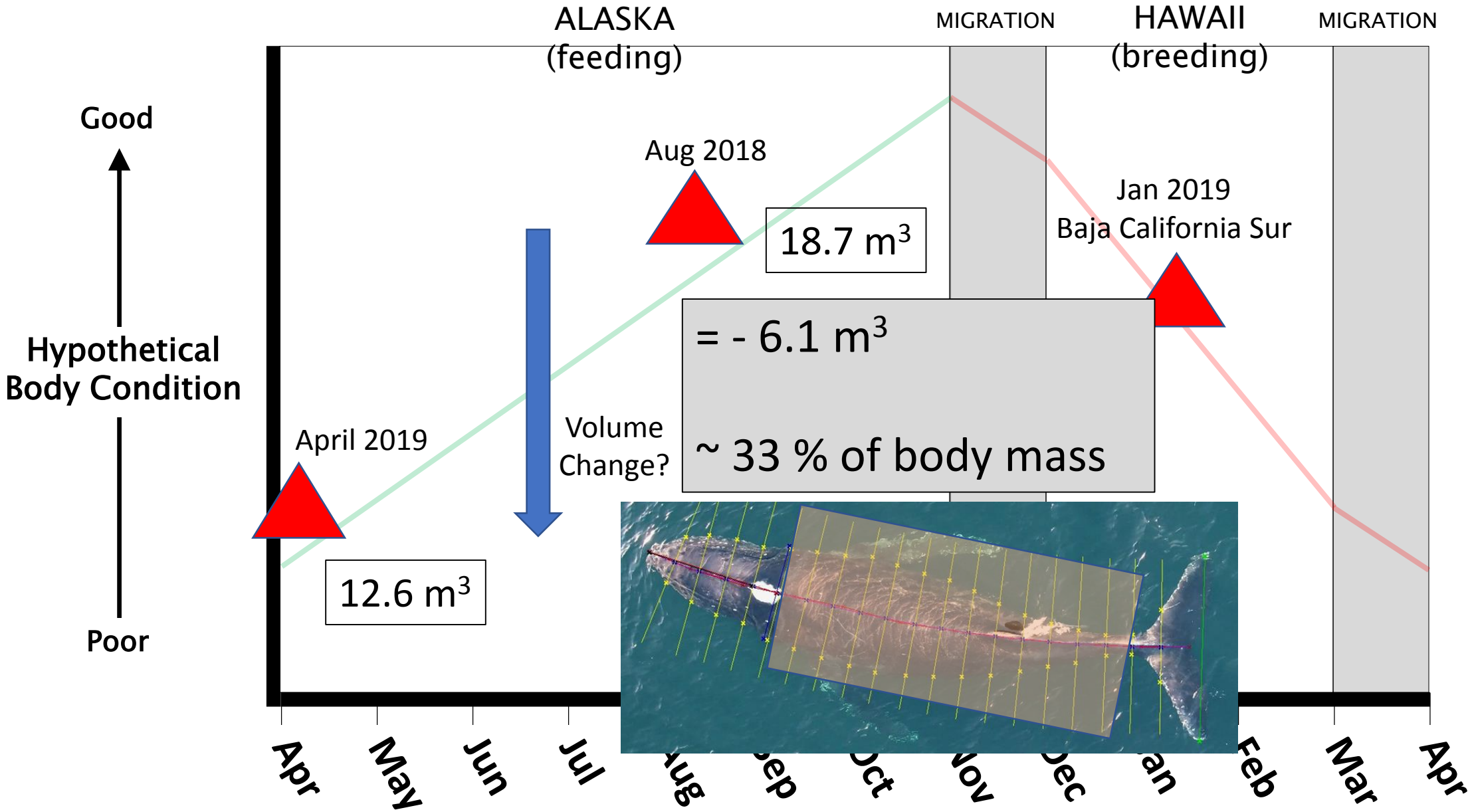
SE Alaska
Apr 2019



Baja Sur, Mexico
Jan 2019

Measured with drone on foraging ground

Sighted on breeding ground in Mexico


ALASKA
(feeding)
MIGRATION
HAWAII
(breeding)
MIGRATION
Good
Hypothetical
Body Condition
Poor
Aug 2018
18.7 m3
Jan 2019
Baja California Sur
= - 6.1 m3
~ 33 % of body mass
April 2019
Volume
Change?
12.6 m3
Apr
May
Jun
Jul
Feb
Mar
Apr

Looking promising....

This is early days, and yet, we are already getting some very interesting results

Gaining a better understanding on the energetic demands that large baleen whales are exposed to during migration

Our UAS imagery is also allowing us to assess scarring rates (entanglements and ship strikes)

Will help inform on possible impacts on climate change

STAY TUNED…….

For questions please email: lbejder@hawaii.edu

All images and biopsies collected under NMFS permits #20311 issued to PIFSC and #19073 issued to AWF and have been approved by UH IACUC