An Alternate Method for Assessing Body Condition of Hawaiian Green Turtles

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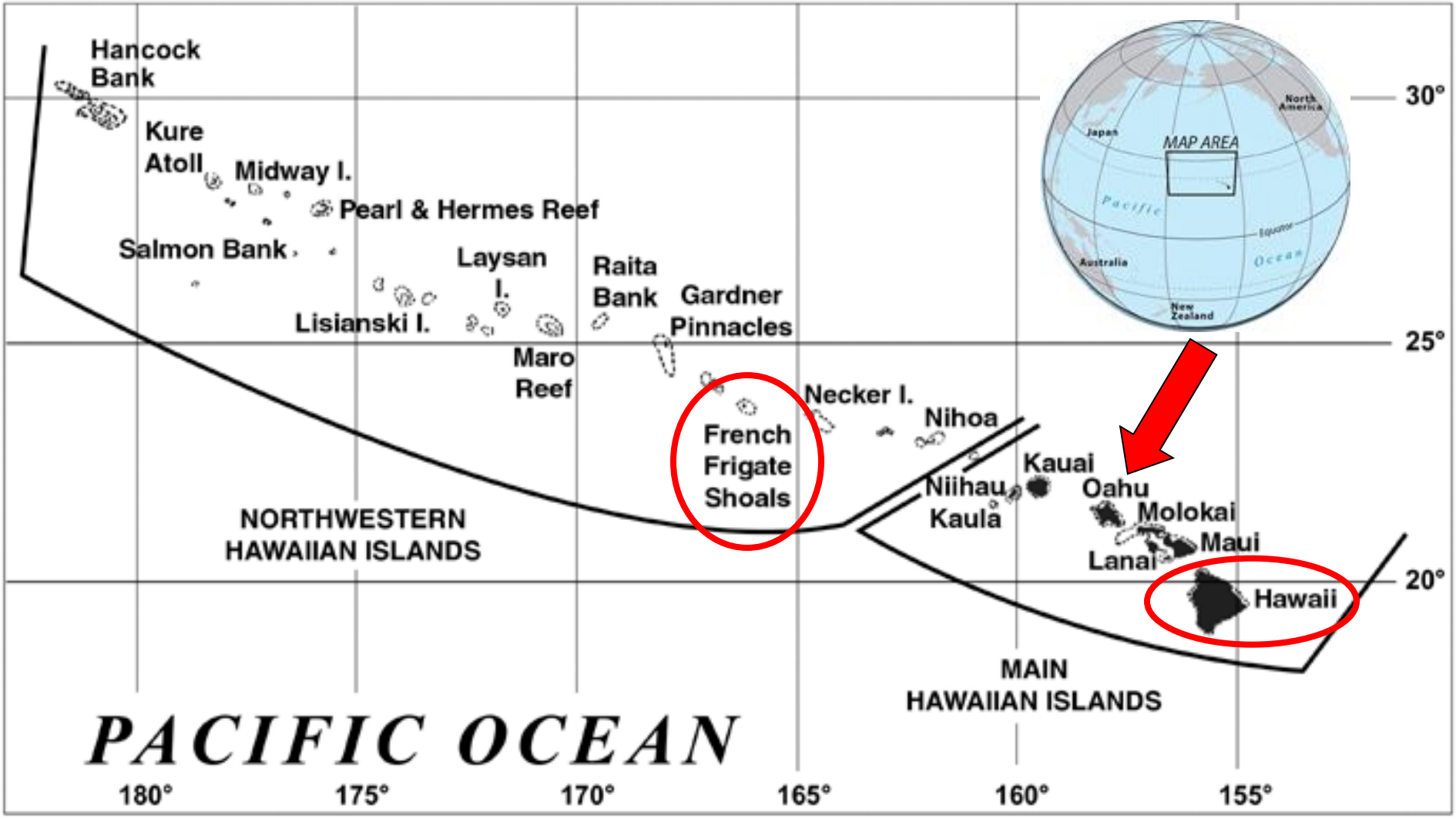
PIFSC Marine Turtle Research Program

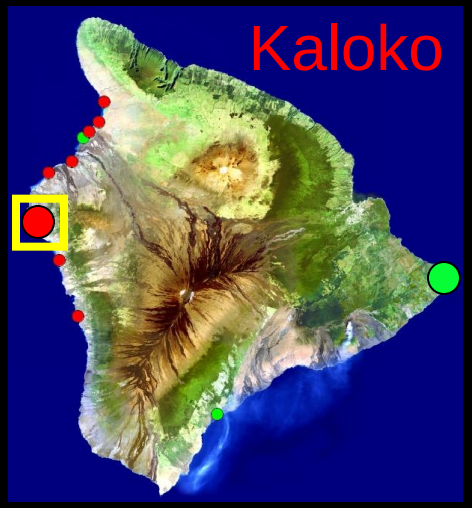

Hancock Bank
Kure Atoll
Midway I.
Pearl & Hermes Reef
Salmon Bank
Laysan I.
Lisianski I.
Raita Bank
Gardner Pinnacles
Maro Reef
French Frigate Shoals
Necker I.
Nihoa
Kauai
Niihau
Kaula
Oahu
Molokai
Maui
Lanai
Hawaii
NORTHWESTERN HAWAIIAN ISLANDS
MAIN HAWAIIAN ISLANDS
PACIFIC OCEAN
30°
25°
20°
180°
175°
170°
165°
160°
155°
MAP AREA
North America
Japan
Pacific
Equator
Ocean
Australia
New Zealand

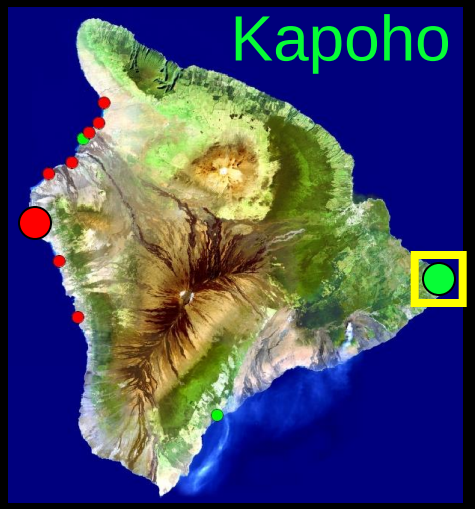
Green Turtles Nesting at East Island, French Frigate Shoals

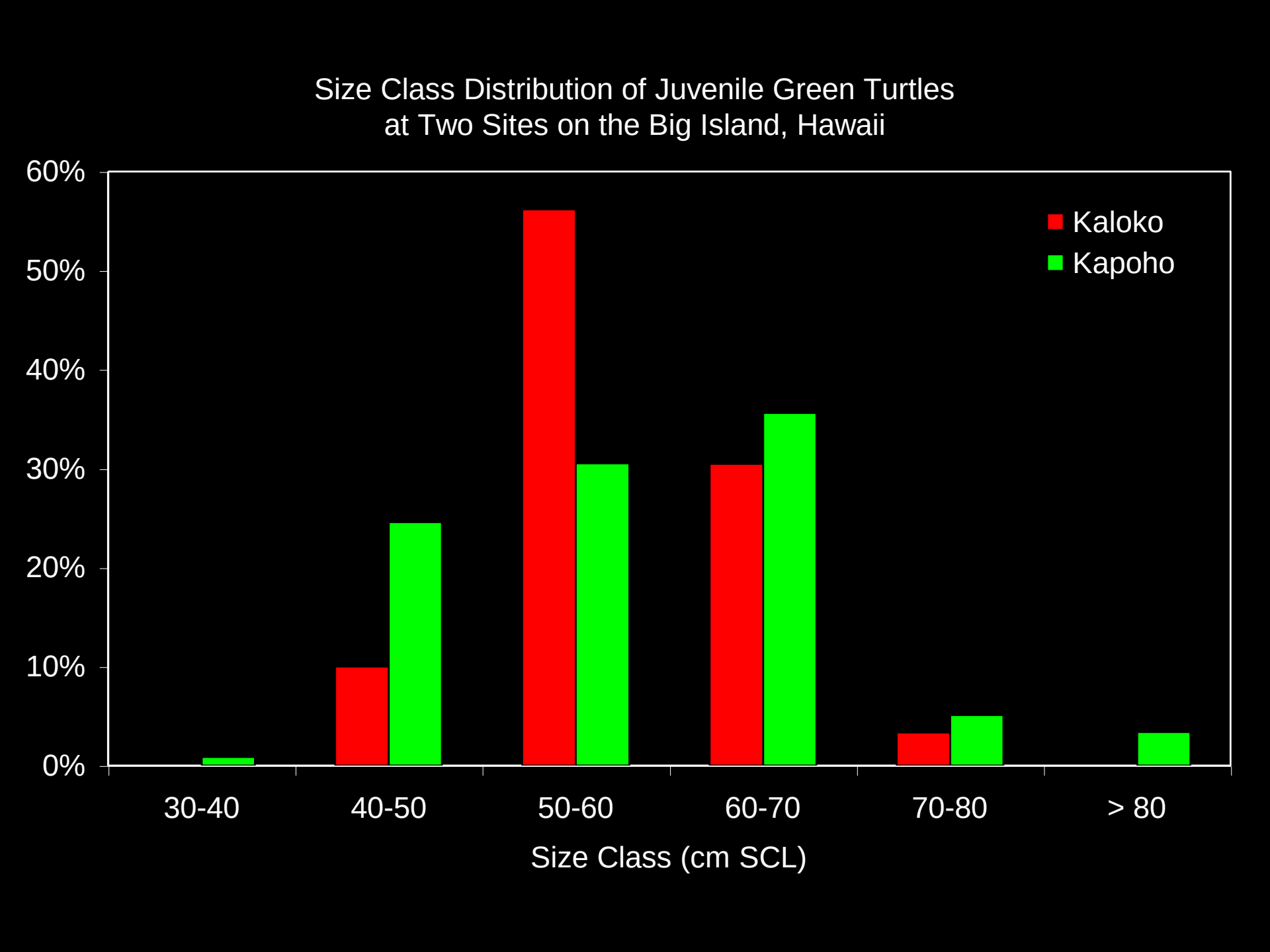
Number of Nesting Females

600
500
400
300
200
100
0

1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005


Kaloko


Kapoho


Size Class Distribution of Juvenile Green Turtles
at Two Sites on the Big Island, Hawaii
60%
50%
40%
30%
20%
10%
0%
Kaloko
Kapoho
30-40
40-50
50-60
60-70
70-80
> 80
Size Class (cm SCL)

Objectives

- Propose an alternative method of quantifying body condition that does not rely on mass
- Compare condition indices across sites on the island of Hawaii
- Quantify body condition field scoring technique

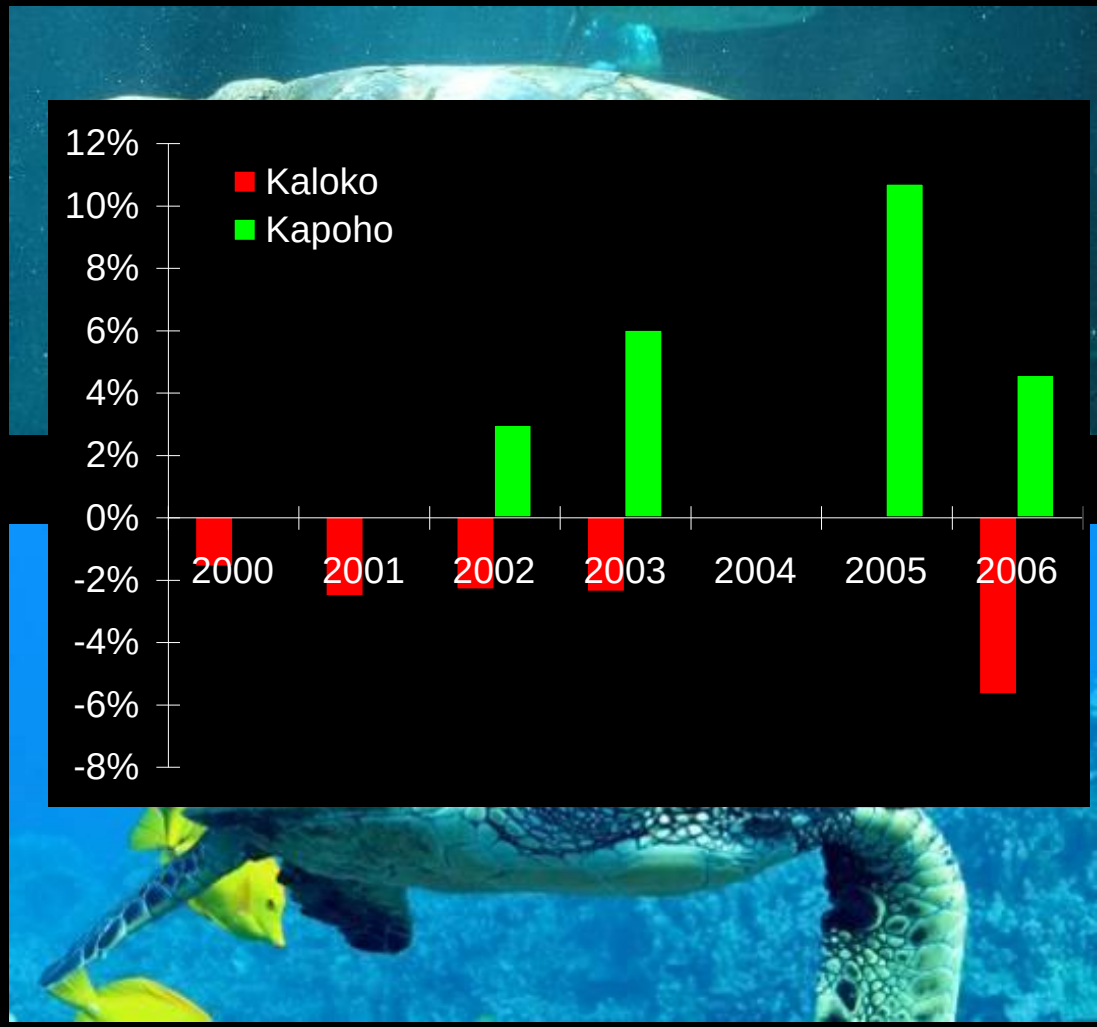
Methods of Quantifying Body Condition

1. Length – Mass Regression
2. Body Mass Residuals
3. Condition Index (CI) based on mass

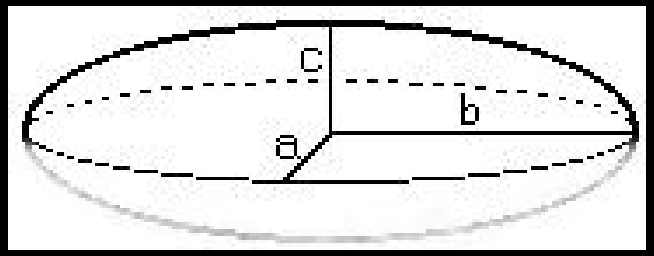
   $CI = Mass / SCL^3$
   (Bjorndal et al. 2000)

4. Condition Index based on Volume

   $CI = Volume / SCL^3$



Condition Index Based on Volume



Volume of an ellipsoid

$V = (4/3 * \pi * a * b * c)$

Volume of a half-ellipsoid

$$V = \frac{(4/3 * \pi * a * b * c)}{2}$$

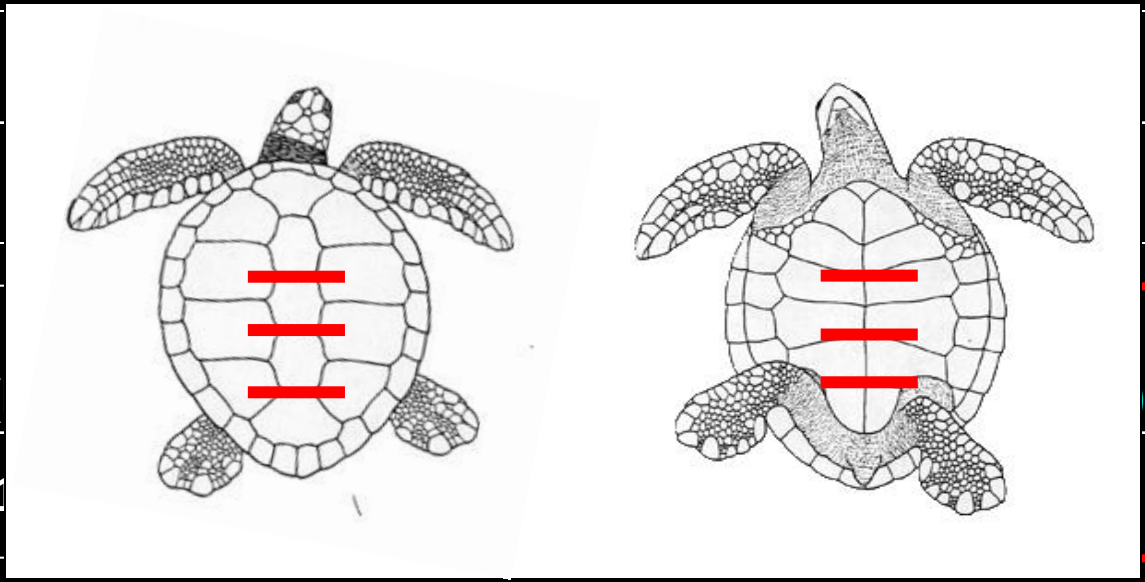
where:

$a = \frac{SCW}{2}$ $b = \frac{SCL}{2}$ $c = LAT$

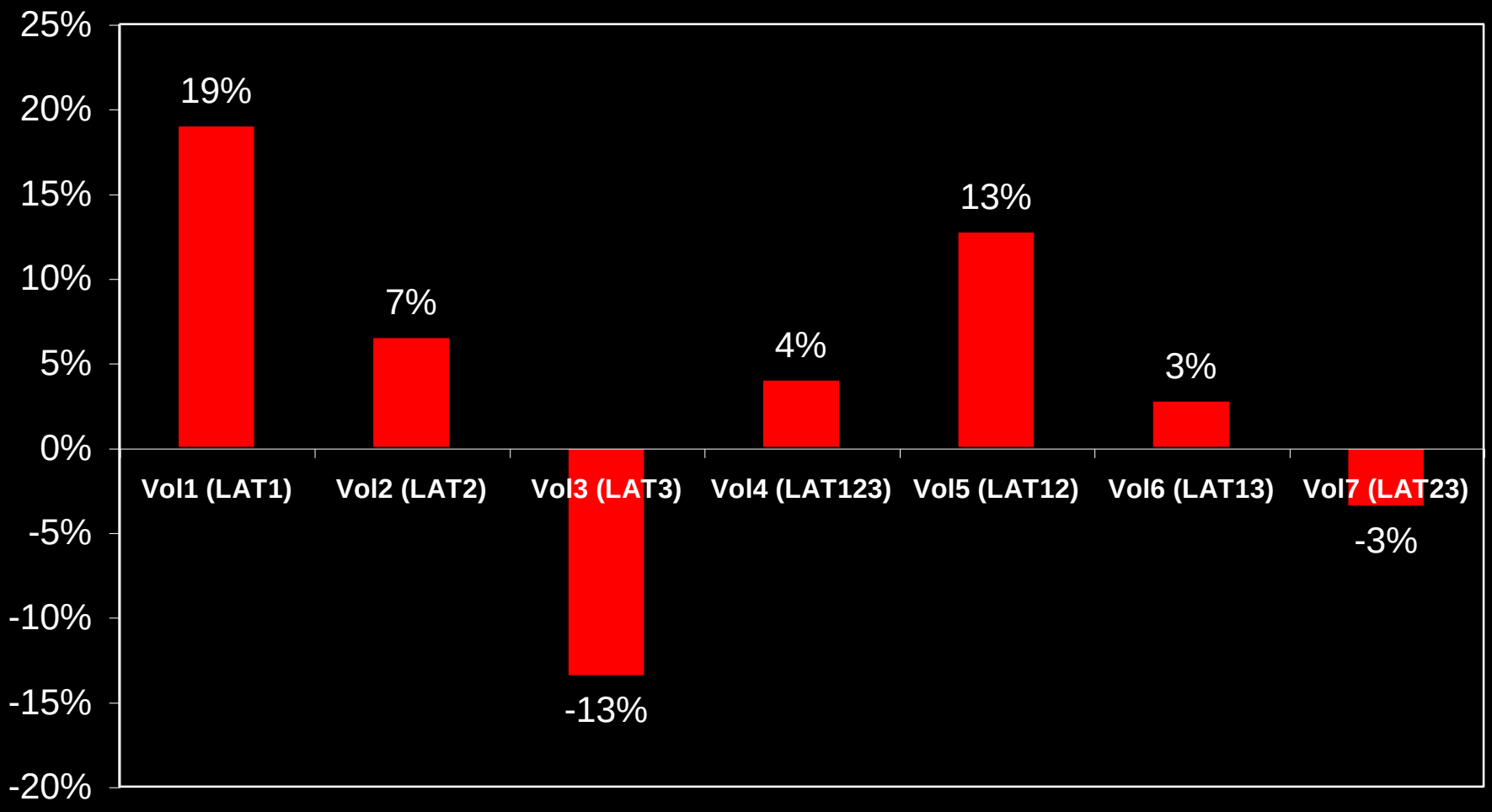
Methods: Volume Calculations

Mass (g)	Lat3
14500	12.3

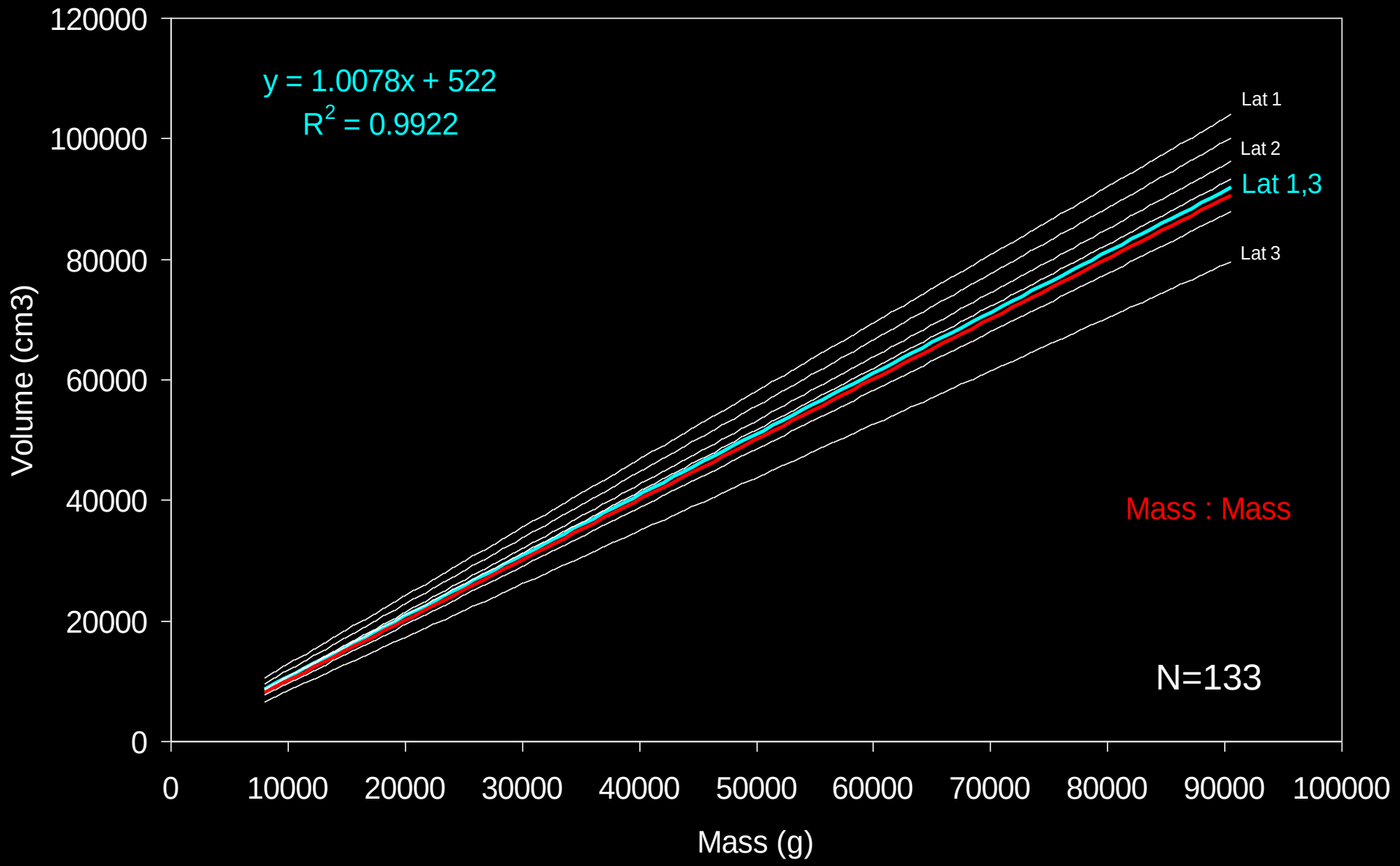
Vol1 (LAT1)	(	Vol7 (LAT23)
17030	1	13063



Average Percent Difference Between Measured Mass and Calculated Volume

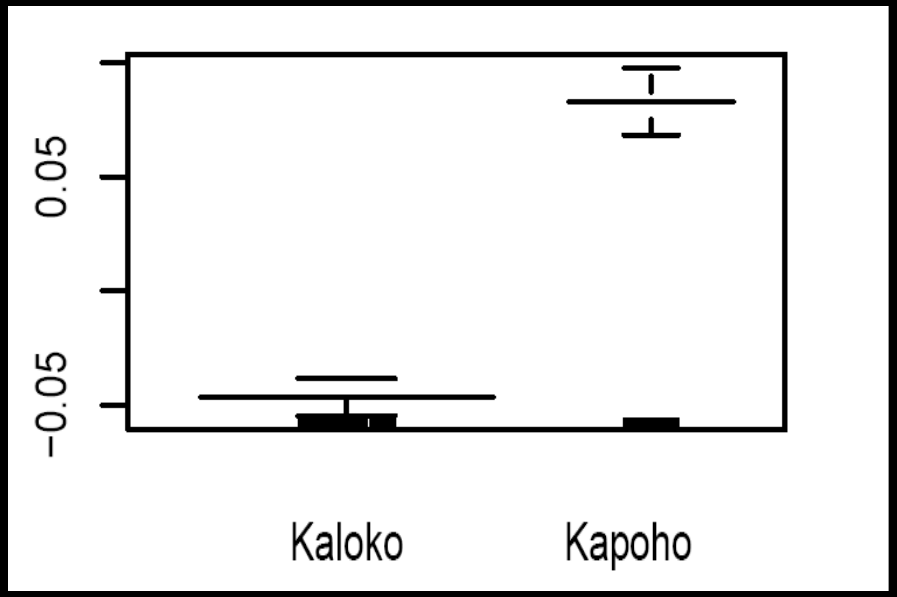


How Well Does Volume Approximate Mass?

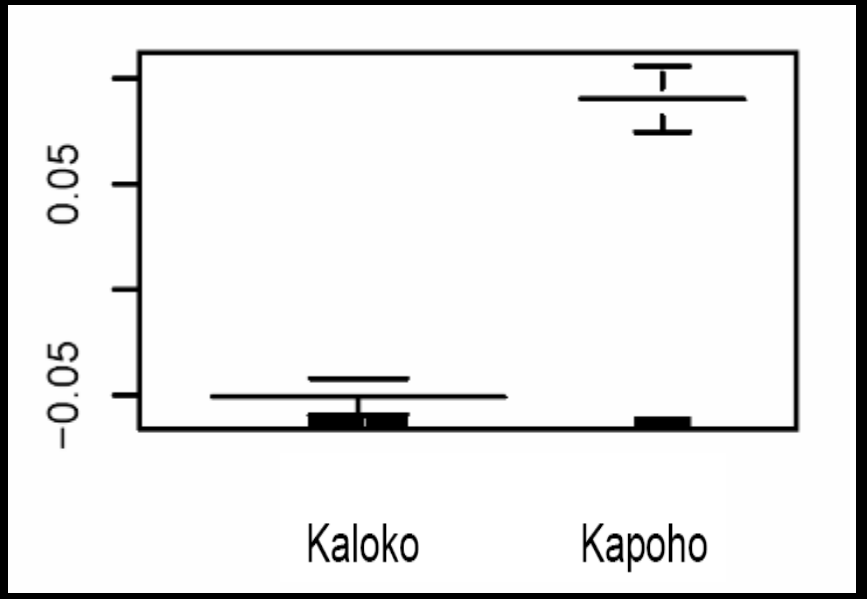


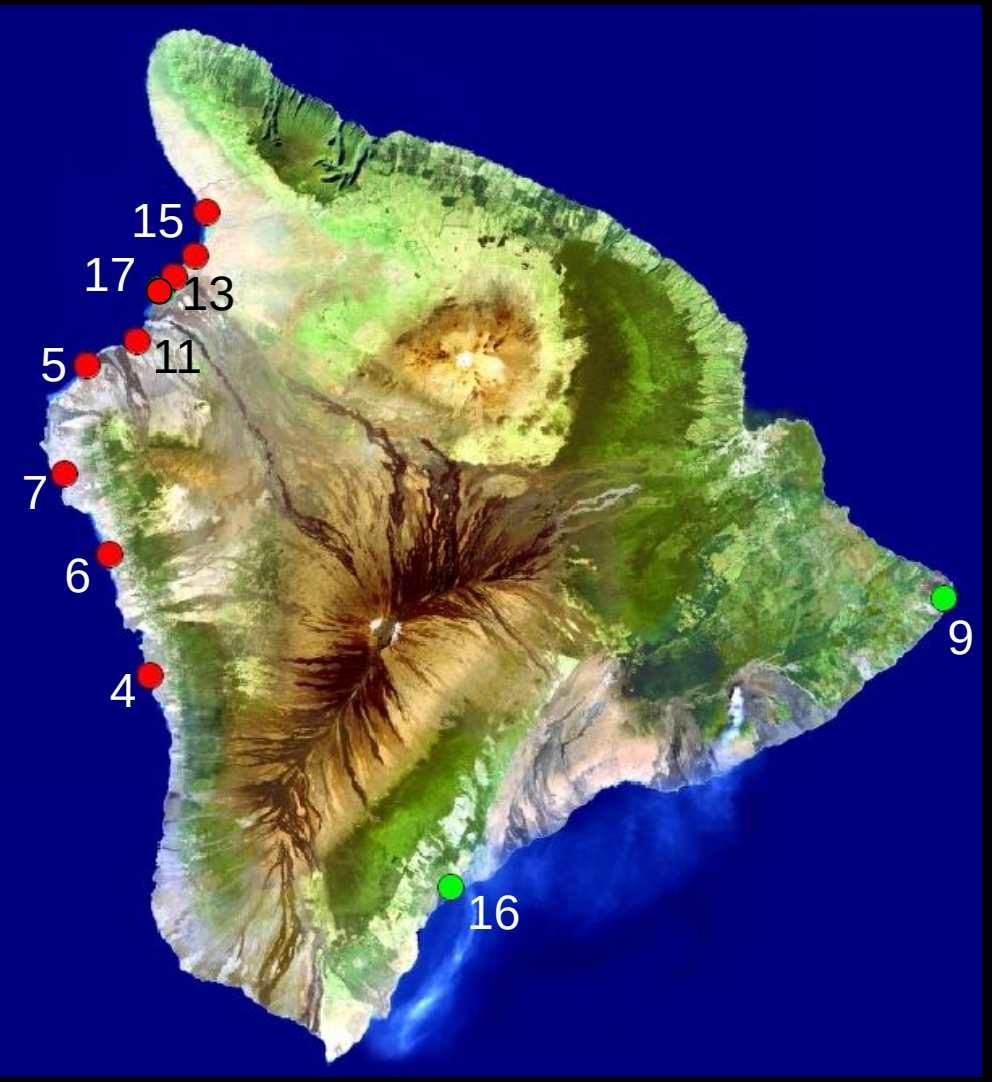
Comparing Condition Indices

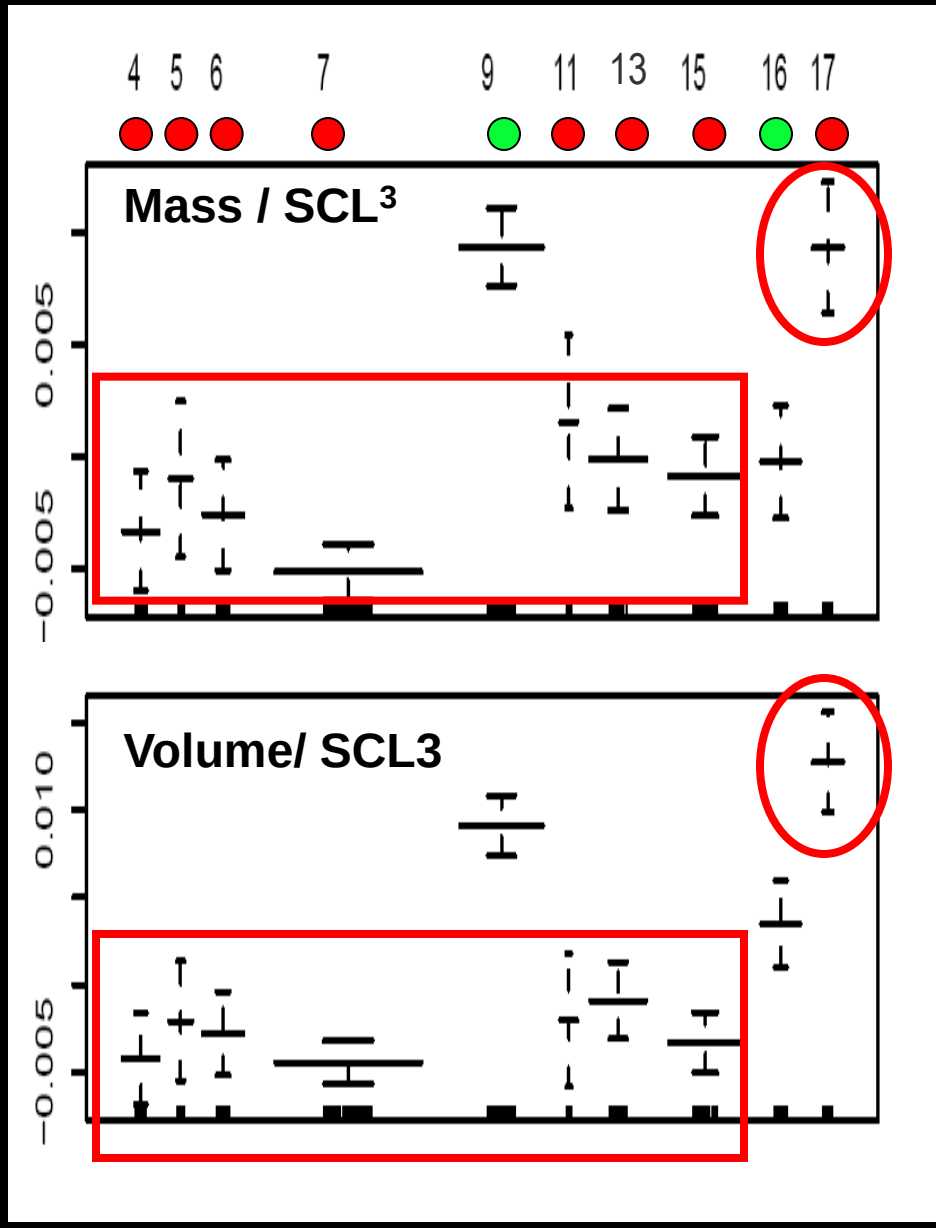
Body Mass / SCL^3



Volume / SCL^3




15
17
13
11
5
7
6
4
9
16


4 5 6 7 9 11 13 15 16 17
Mass / SCL³
0.005
−0.005
Volume/ SCL3
0.010
−0.005

Body Condition Field Scores

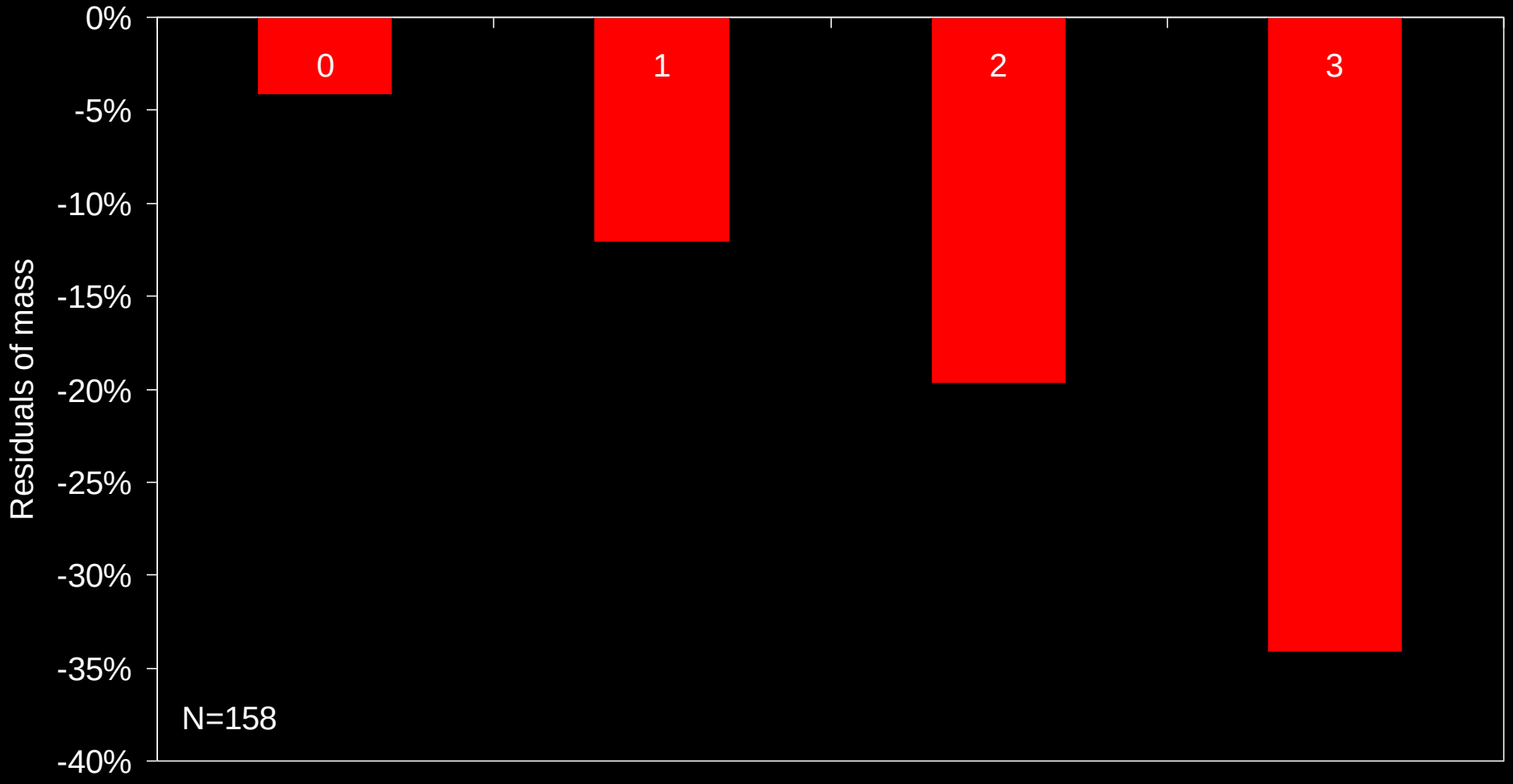
Robust – Normal

Mild Emaciation

Moderate Emaciation

Severe Emaciation

Field Scores – Stranded Turtles



Discussion

- Declining growth rates over time coupled with poorer body condition at Kona sites
- Virtually no FP on the Kona coast – otherwise healthy animals are maturing slower and the contribution of animals from these sites to the nesting population may be reduced
- Foraging grounds may be reaching their carrying capacity – or are turtles simply surviving and not thriving?

Conclusions

- Volume is a good proxy for mass
- Differences in body condition exist among sites
- Field scores represent turtles that are 10, 20, and 30% below expected weight
- Maximize data collection for each turtle

Acknowledgements

- NMFS MTRP Staff

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