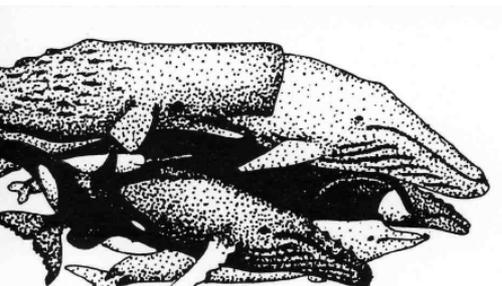


# Size and Body Condition of Southern Residents

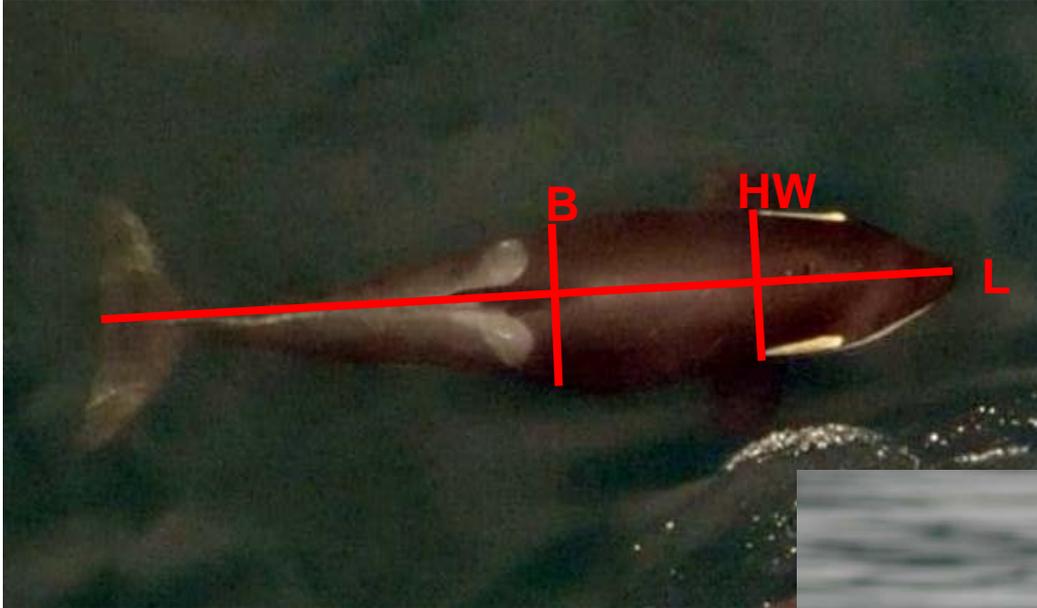


*John Durban, Holly Fearnbach  
Ken Balcomb, Dave Ellifrit*

*John.Durban@noaa.gov*



# *Photogrammetry tools*



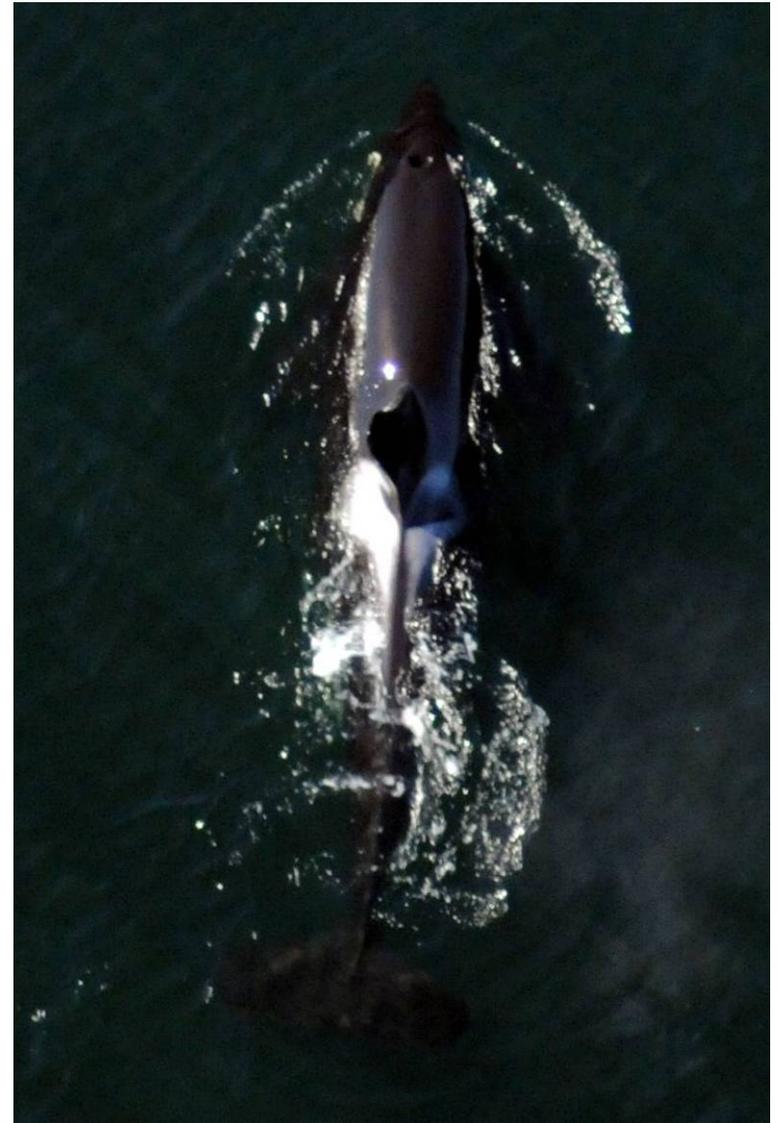
# *Aerial photogrammetry: size and condition*



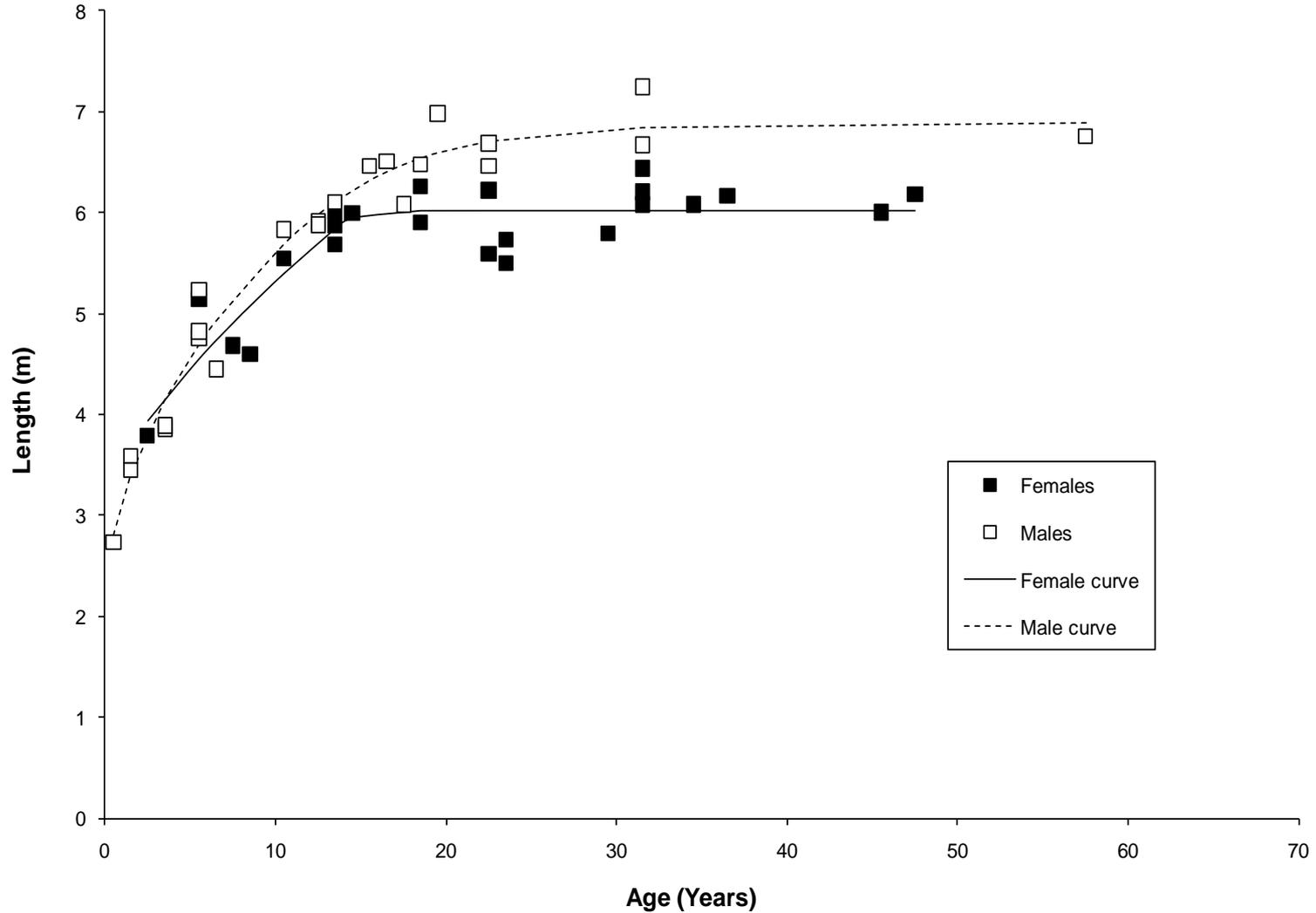
Fearnbach, Durban, Ellifrit and Balcomb. 2011. *Endangered Species Research* 13, 173-180.



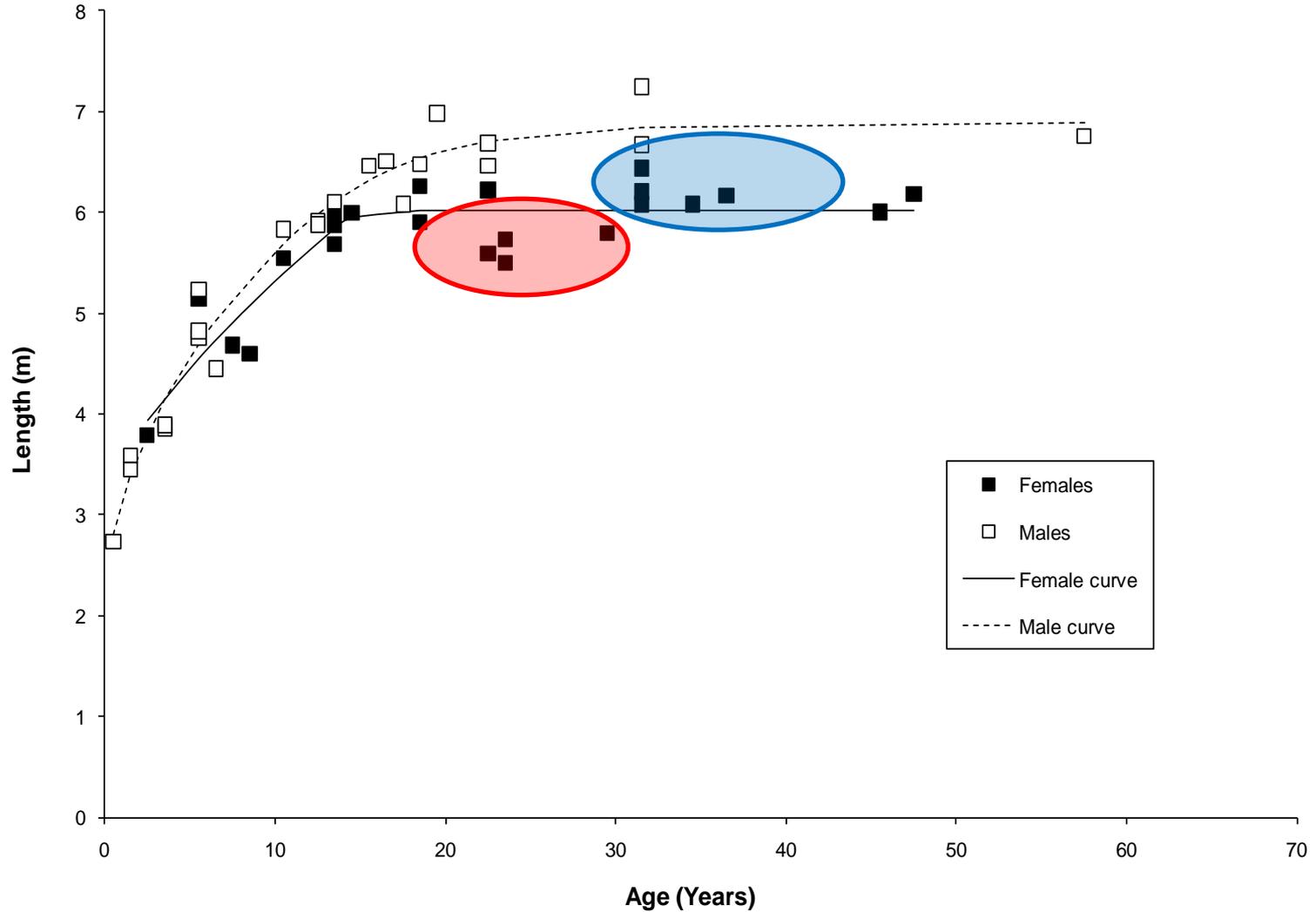
***Monitoring individuals (L78, male, born 1989 )***



# Asymptotic length at age curves, 69 whales



# *A hint at growth trends*



# ***Direct monitoring of individual growth***



Durban & Parsons.  
2006. *Marine  
Mammal Science* 22,  
735-743.



# *Extrapolating to length*

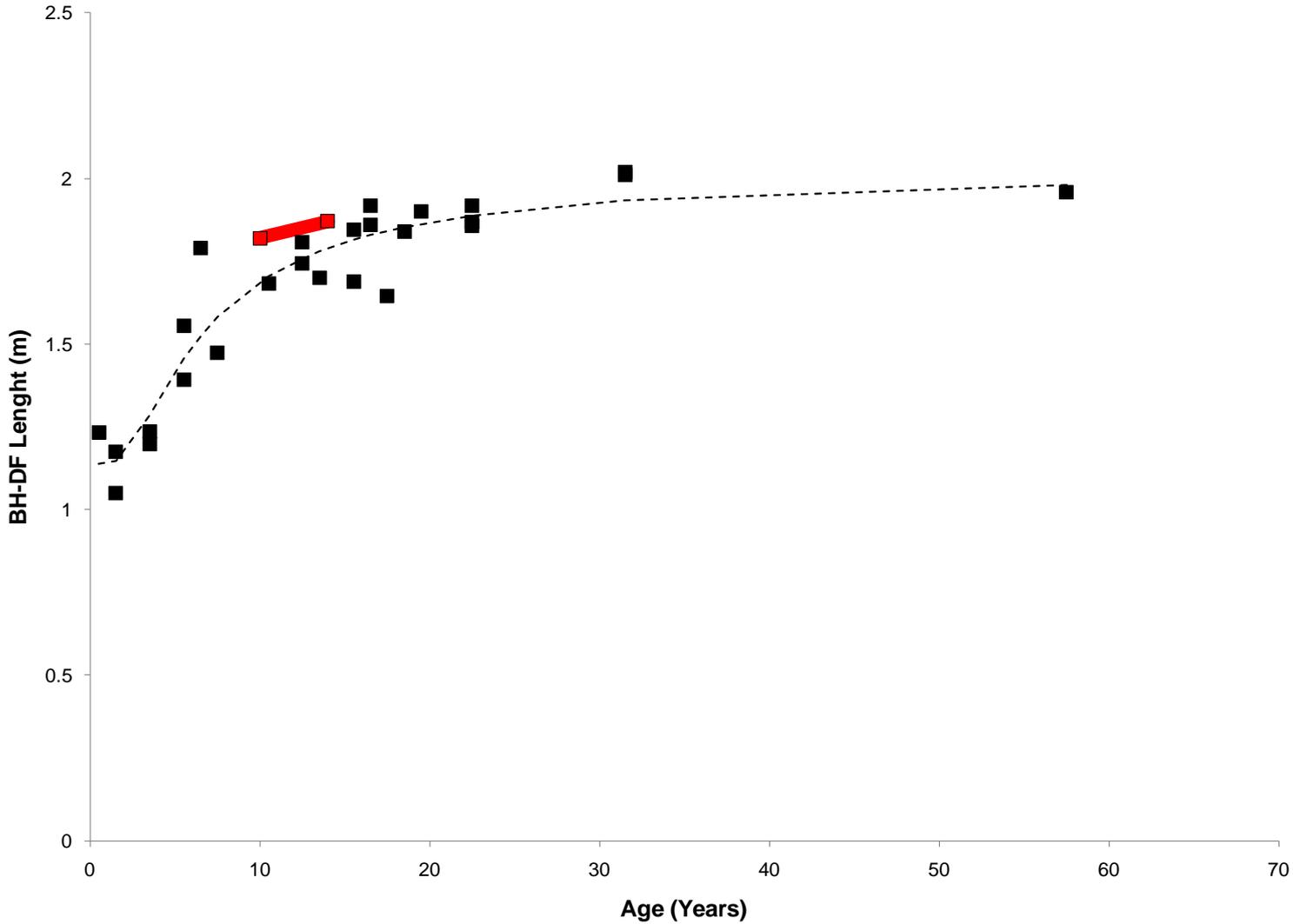
**J30 in 2004, Age = 10, fin = 88cm**



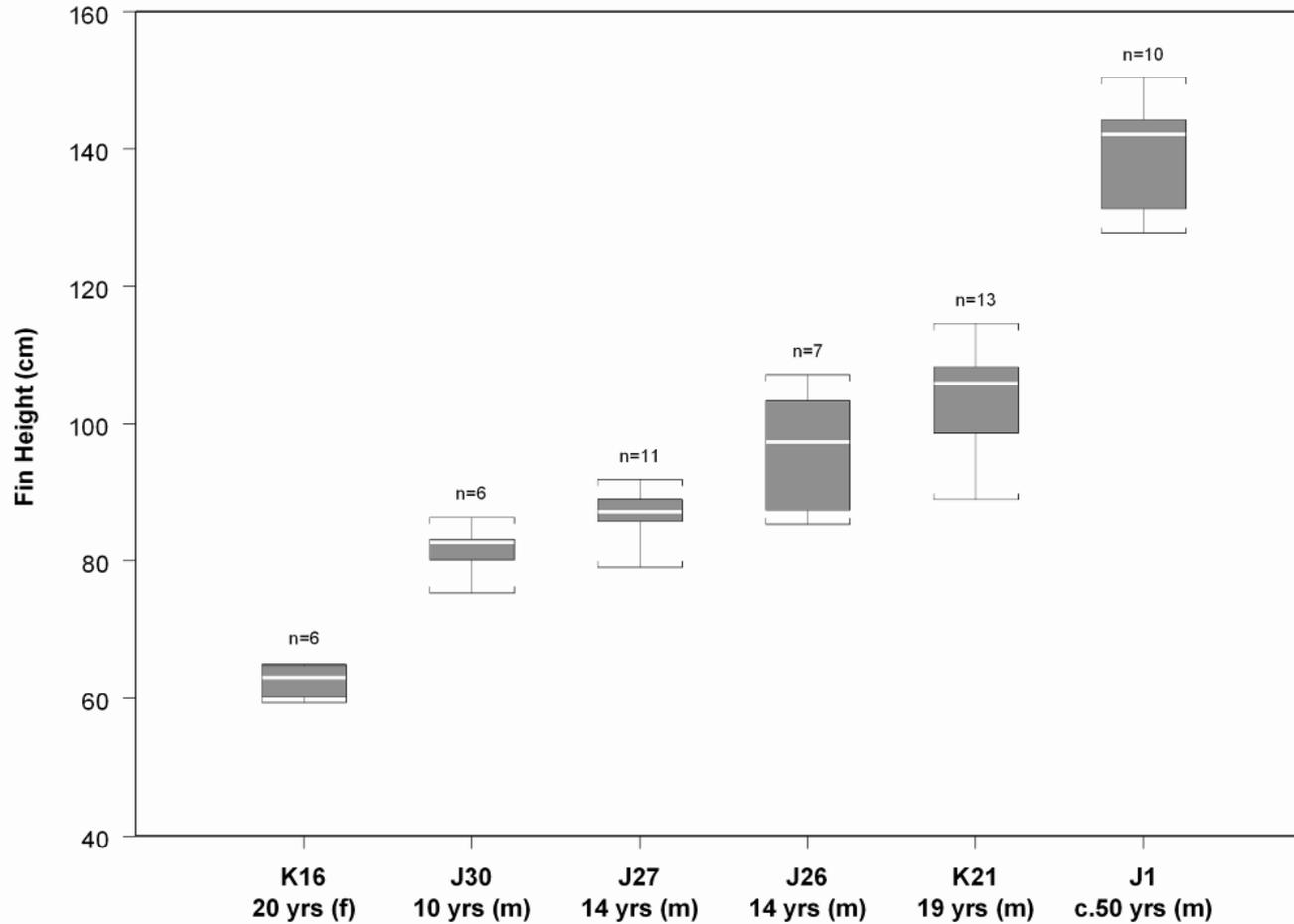
**J30 in 2008, Age = 14, fin height = 128 cm**



# ***Lasers: Monitoring individual growth***



# Sexual dimorphism in the dorsal fin



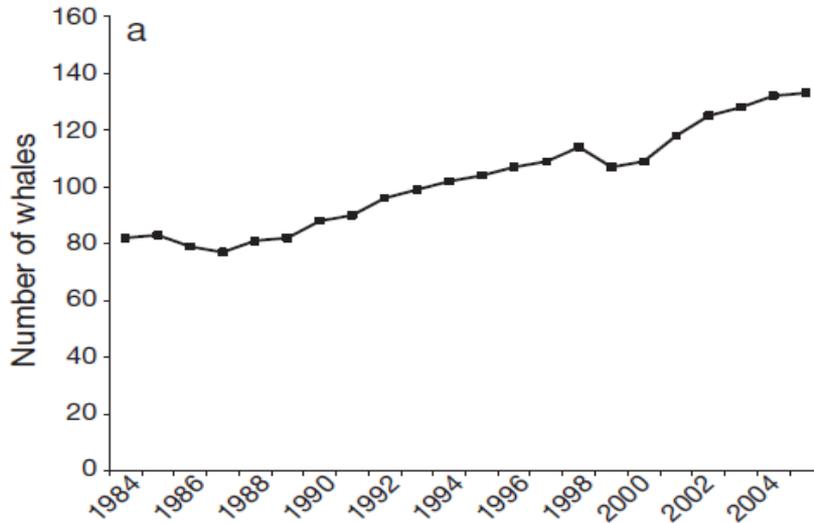
Durban & Parsons. 2006. *Marine Mammal Science* 22, 735-743.

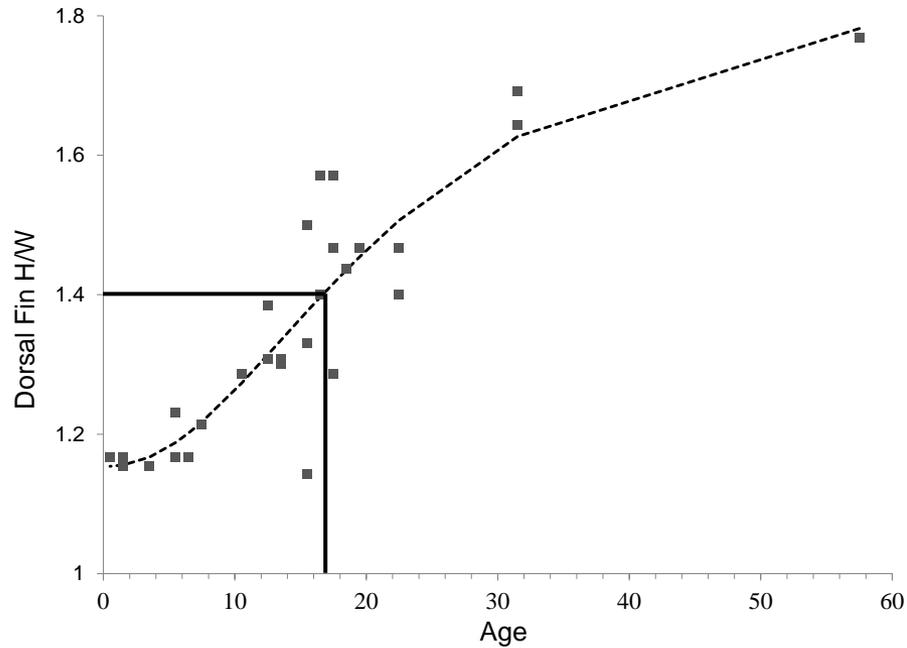
# A comparative approach

**Southern Residents**  
(Center for Whale Research)



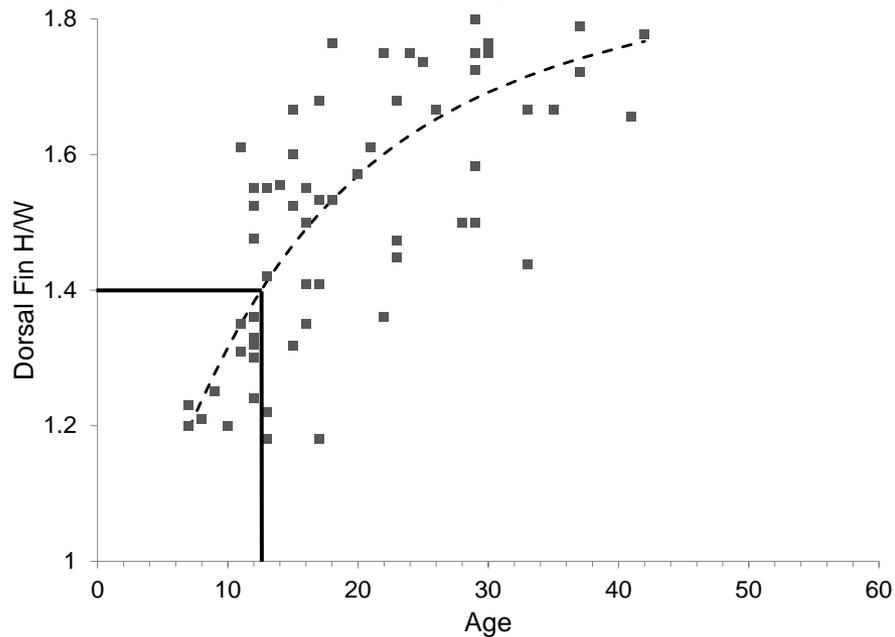
**Gulf of Alaska Residents**  
Growth at >3% per year  
(Matkin et al. 2008)





## Southern Residents

H/R = 1.4 at **17-18 years**



## Gulf of Alaska Residents

H/W = 1.4 at **12-13 years**



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## LOCAL

Last updated October 24, 2008 11:39 p.m. PT

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Nancy Black / Monterey Bay Whale Watch

Orcas from L pod, usually seen in state waters, surface near Cypress Point, Calif. Scientists suggest the pod may be driven to swim hundreds of miles just to meet minimum nutritional requirements.

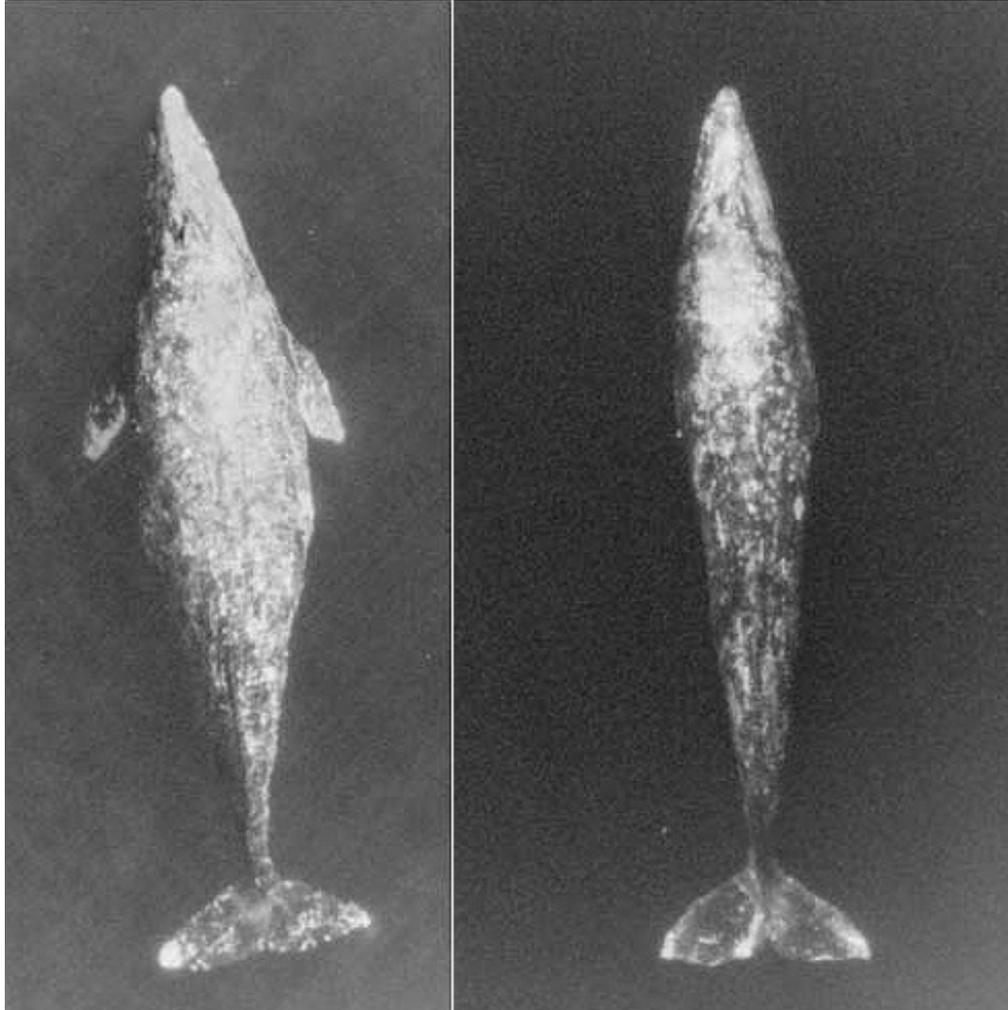
### **Are the orcas starving?**

**As salmon runs decline, killer whale numbers take hardest hit since 1990s**

By **ROBERT McCLURE**  
P-I REPORTER

Obvious signs of starvation as salmon runs falter and die down. The

# ***NOAA SWFSC: Photogrammetry expertise***



# *Body condition*

**Robust**



**Thin**



Durban, J., Fearnbach, H., Ellifrit, D. and Balcomb, K. 2009. Size and body condition of southern resident killer whales. Contract report to the NMFS Northwest Regional Office.

## ***Comments from NWFSC***

“...the Durban et al. report does not fully support the idea that photogrammetric data as currently collected will necessarily allow accurate assessment of nutritional status, due to relatively high measurement error”.

“...measurements from aerial photogrammetry did not detect that L67, an animal that clearly showed classic signs of emaciation, was thinner than other whales”.

## ***Clarification: Durban et al. 2009 conclusions***

“The neonate K42 had the maximum estimated head width of 17% of the estimated body length. Conversely, the mother of K42 (K14) had the smallest head width to body length ratio (10%), likely indicating a decrease in body condition due to the energetic burden of lactation”.

“The female with the second smallest head width ratio was **L67**, **who’s head was thinner than all other adult females**”.

“These data indicate the potential of aerial photogrammetry to detect changes in body condition”.

# ***Bias ~ 7cm with known-size boats***

***R/V Orca***

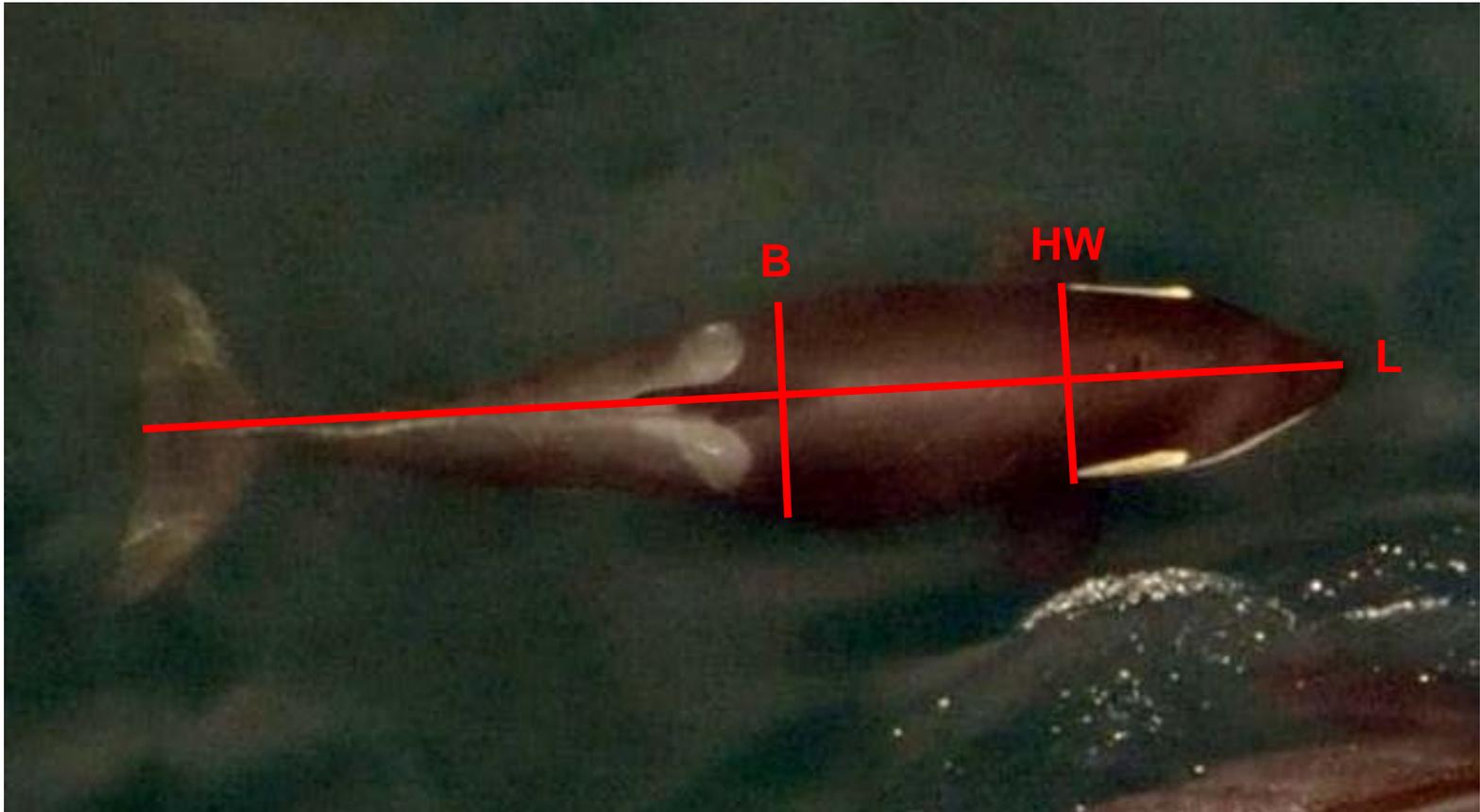


***R/V Starlett***

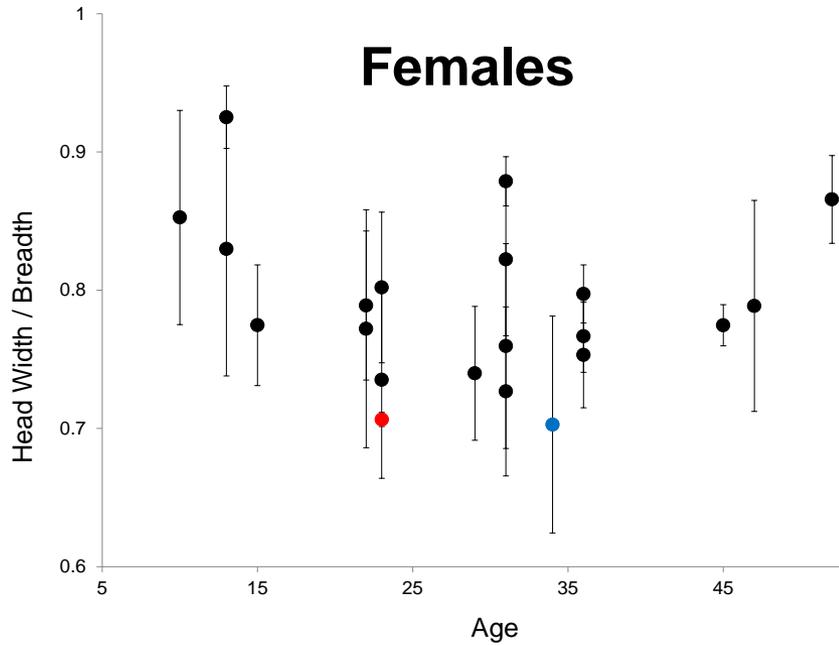


***Scale = altitude / focal length***

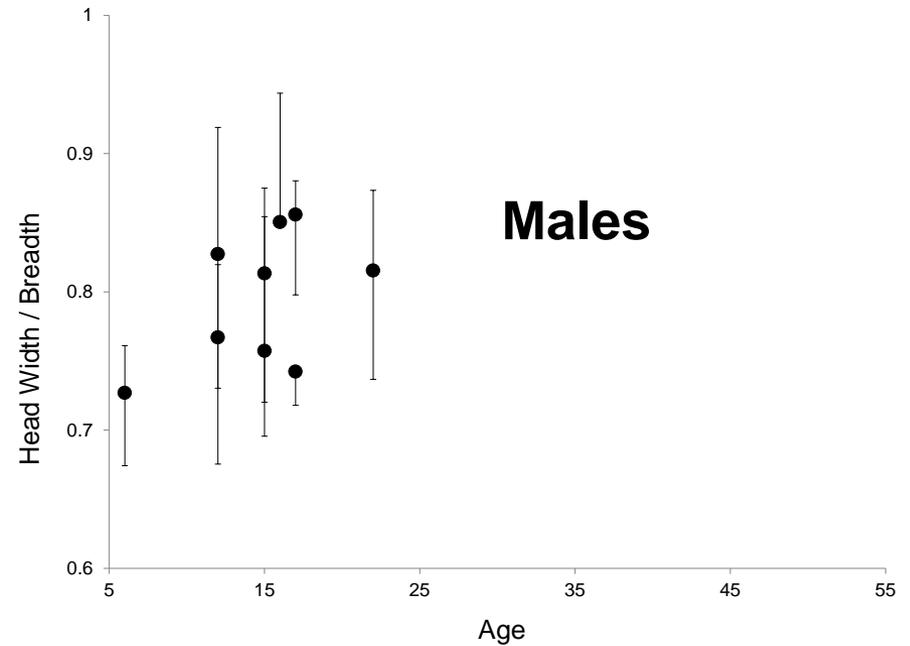
***Relative shape not subject to altitude error***



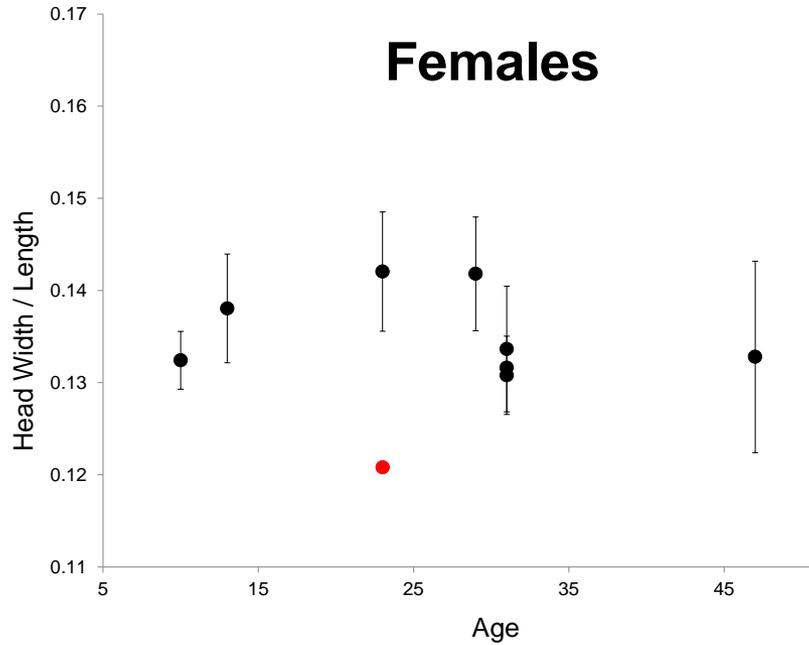
# Relative shape: Head Width / Breadth



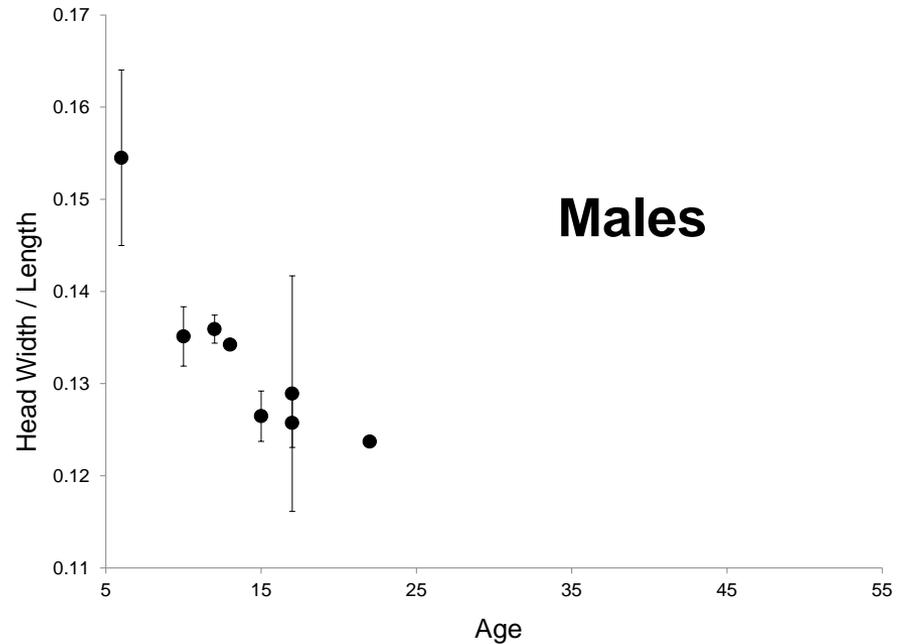
Average CV = 0.07



# *Relative shape: Head Width / Length*



**Average CV = 0.03**



## ***Comments from NWFSC***

**X**the Durban et al. report does not fully support the idea that photogrammetric data as currently collected will necessarily allow accurate assessment of nutritional status, due to relatively high measurement error”.

**X**measurements from aerial photogrammetry did not detect that L67, an animal that clearly showed classic signs of emaciation, was thinner than other whales”.

## ***More from NWFSC***

“We agree that photogrammetry is a potentially very useful tool for assessing condition. However, here and elsewhere we think the report perhaps overstates the precision of the data that are **currently available**”.

## *More from NWFSC*

“We agree that photogrammetry is a potentially very useful tool for assessing condition. However, here and elsewhere we think the report perhaps overstates the precision of the data that are **currently available**”.

**We need repeated longitudinal data**

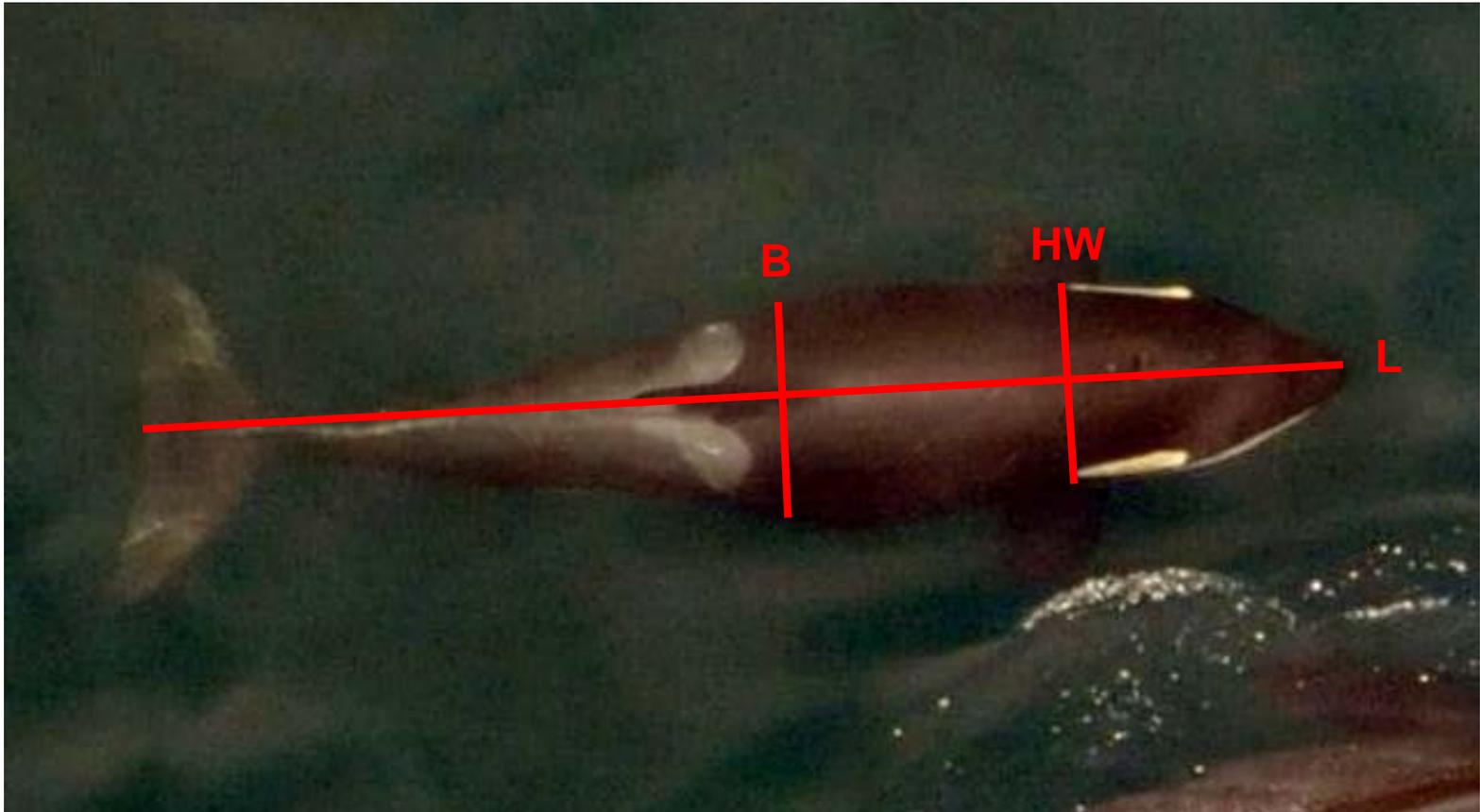
## ***More from NWFSC***

“We agree that photogrammetry is a potentially very useful tool for assessing condition. However, here and elsewhere we think the report perhaps overstates the precision of the data that are **currently available**”.

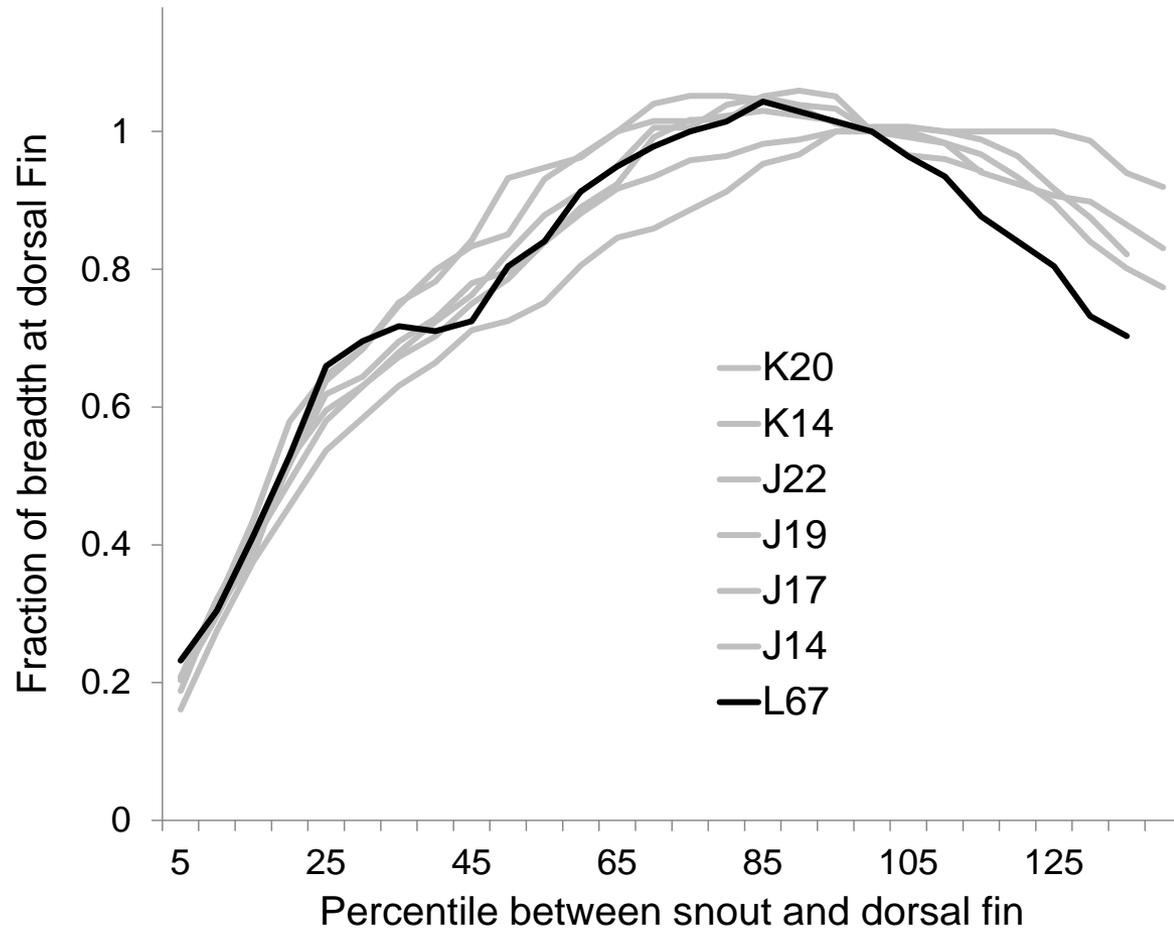
**“More context..”**

**We need repeated longitudinal data**

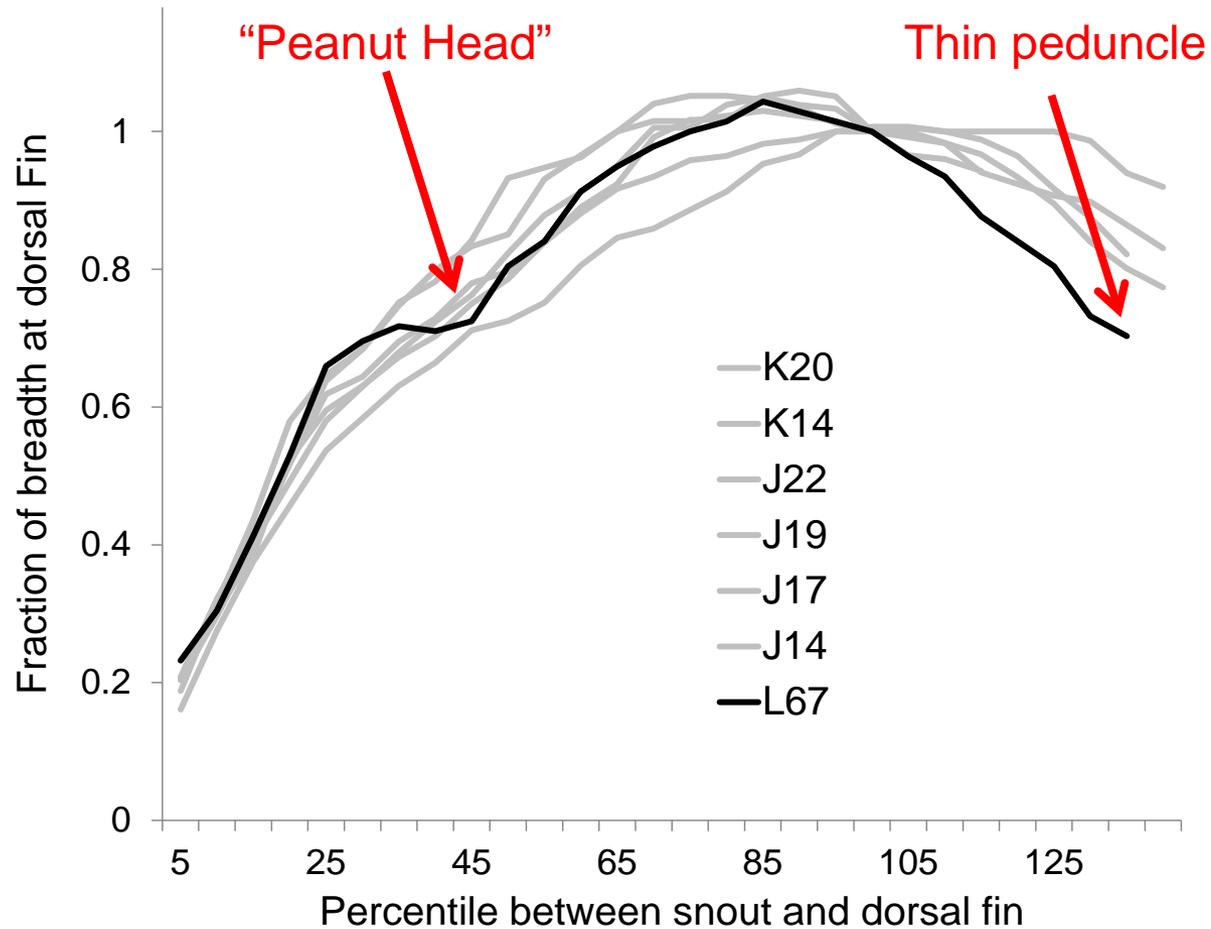
***In preparation: more sensitive metrics***



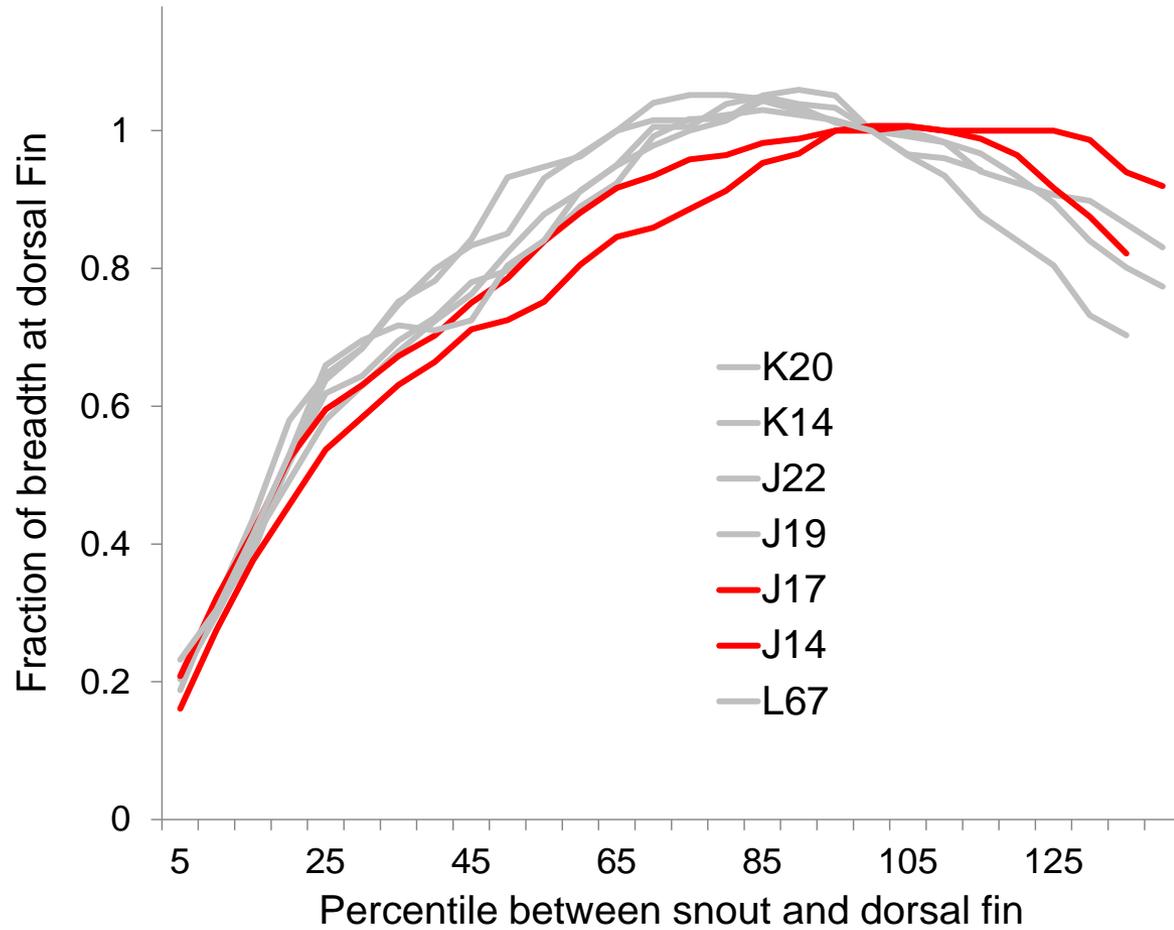
# *In preparation: shape profiles*



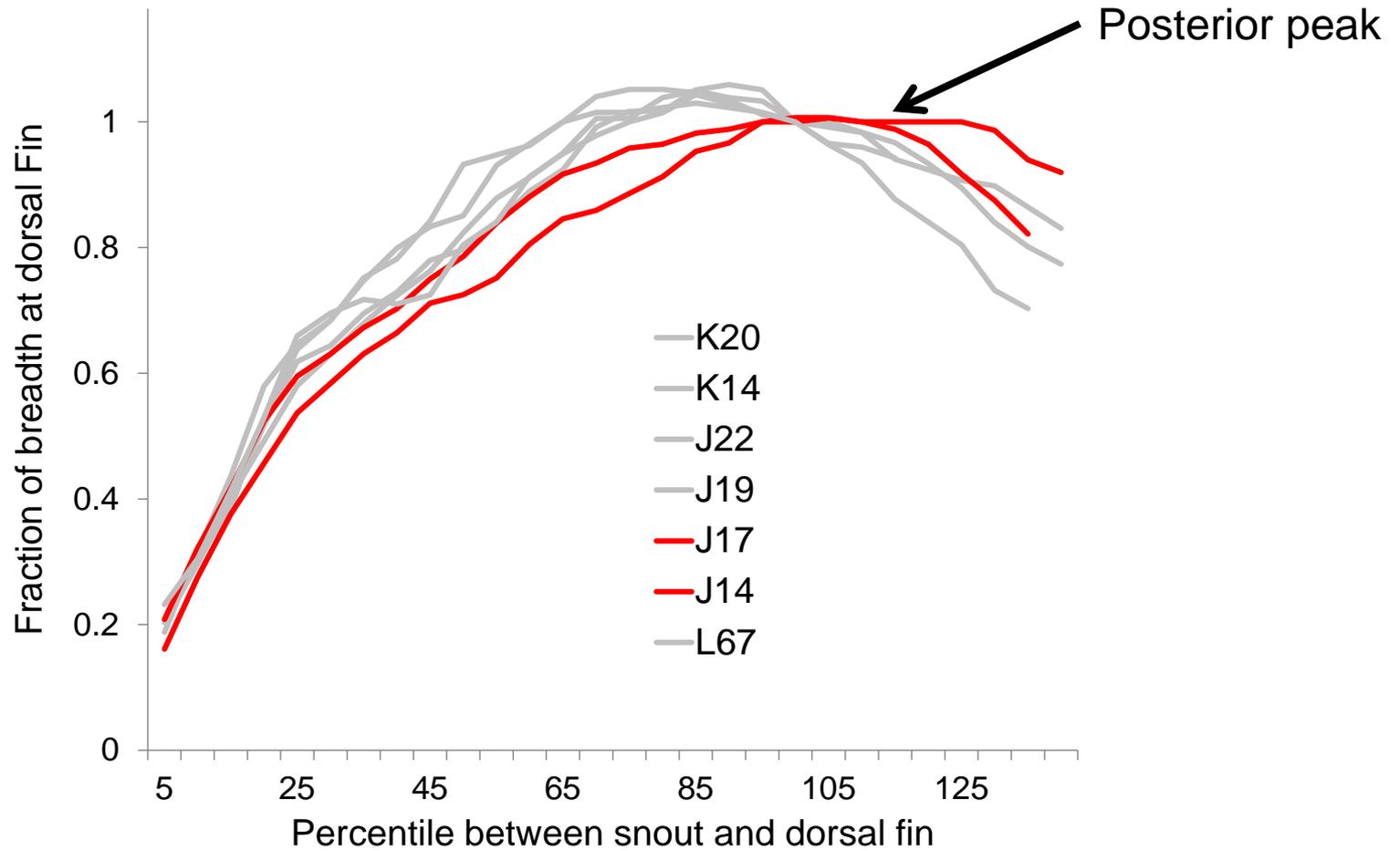
# *In preparation: shape profiles*



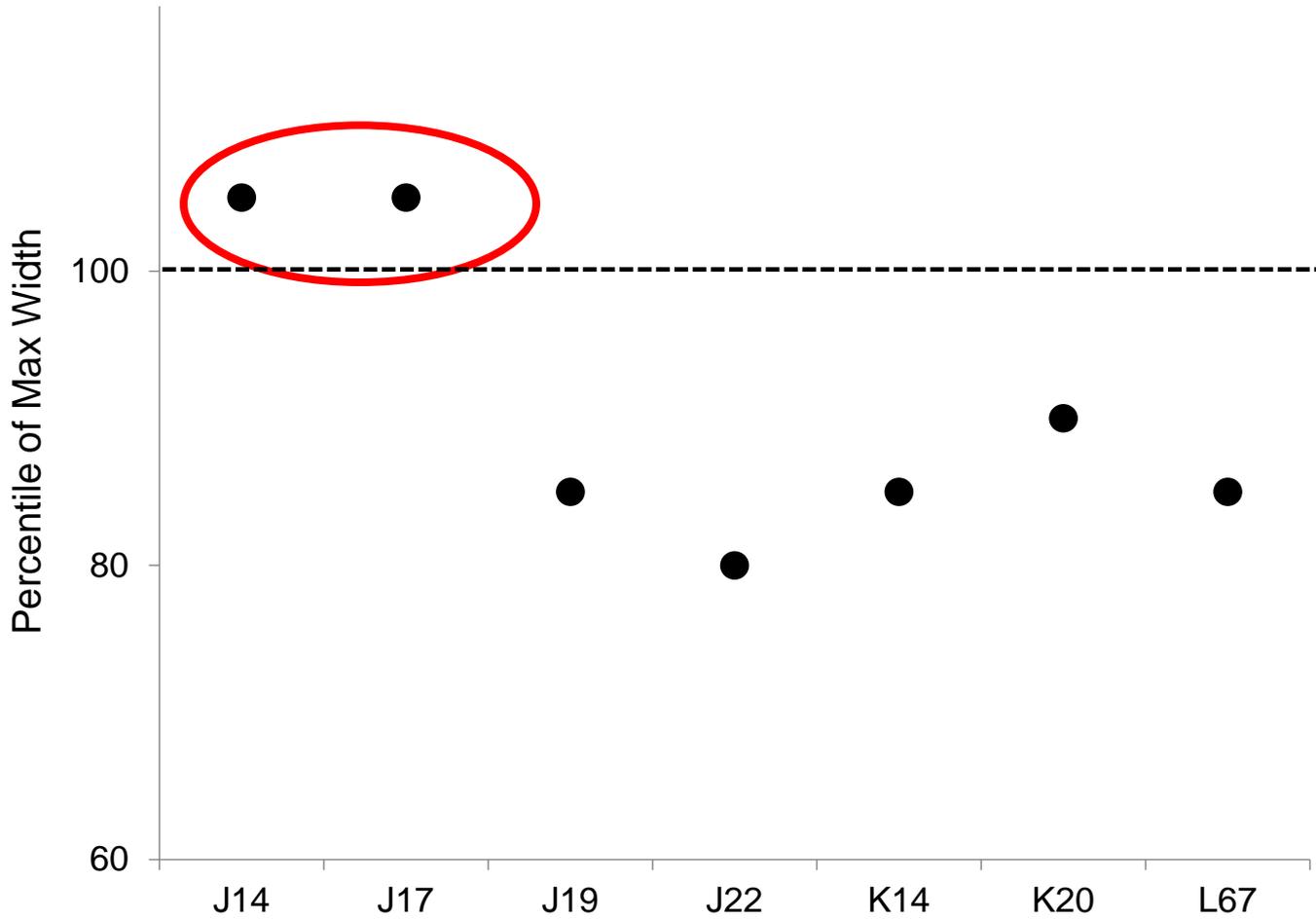
# *In preparation: shape profiles*



# *In preparation: shape profiles*



# *In preparation: shape profiles*





Pitman et al. *Journal of Mammalogy*  
88, 43-48.



