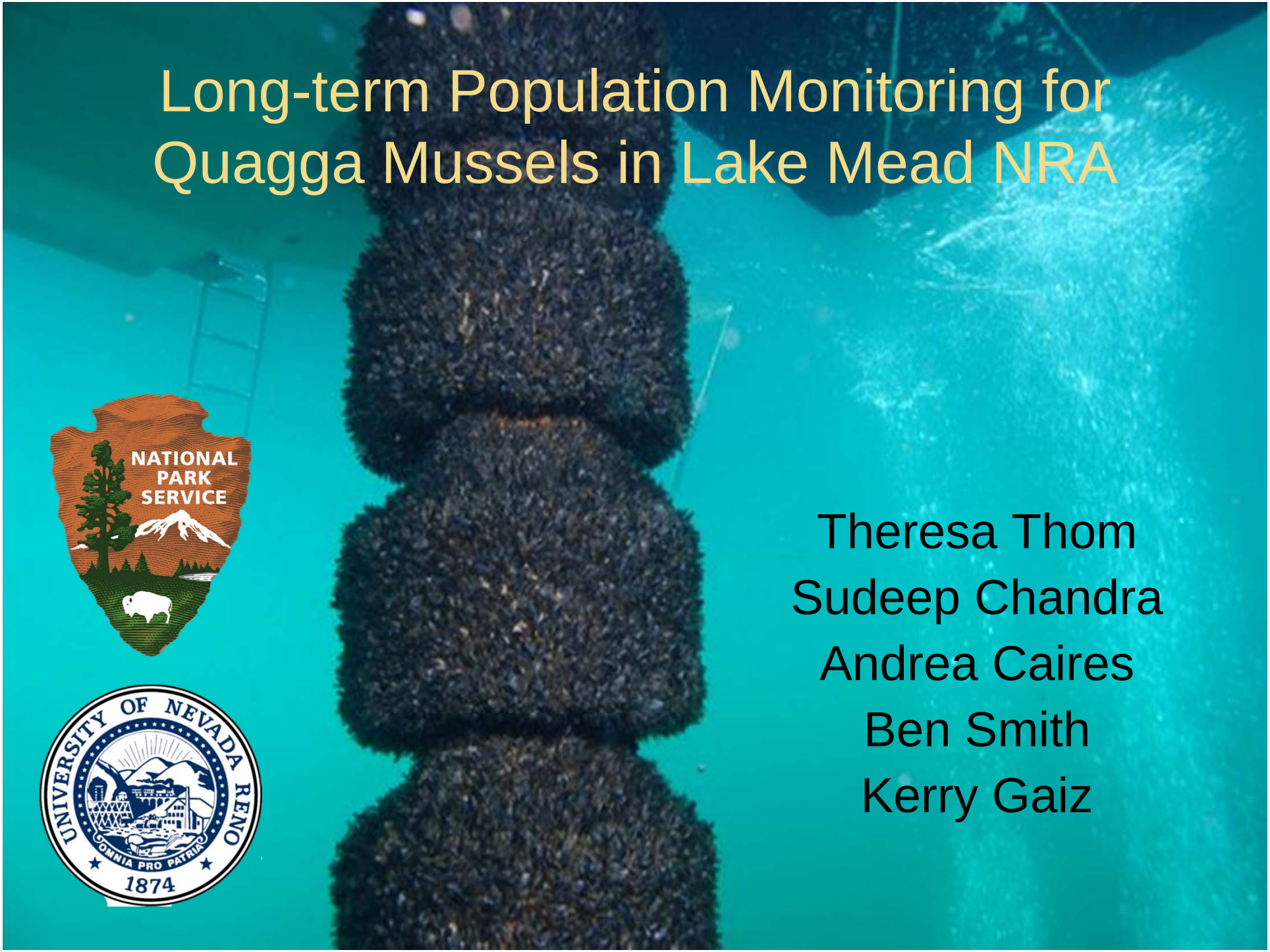
Long-term Population Monitoring for Quagga Mussels in Lake Mead NRA



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NATIONAL PARK SERVICE

DRI
Desert Research Institute

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

USGS
science for a changing world

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NEVADA DEPARTMENT OF WILDLIFE

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Southern Nevada Water Authority

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

ARIZONA GAME & FISH

AIS Efforts at Lake Mead NRA

Prevention

Education

Research

Research

Interagency Monitoring Action Plan (IMAP)

Monitoring	Participating Agencies
1. Quagga Mussels (adults, juveniles, and veligers)	NPS/USBR/SNWA/CWC/UNLV/ NDOW
2. Water Quality	USBR/SNWA/CWC/NPS/USGS
3. Fish and Invertebrates	NPS/NDOW/UNLV/UNR
4. Infrastructure Maintenance and Public Education	NPS/NDOW/SNWA/USBR/UNLV

Quagga Mussel Monitoring

Adult & Juvenile Mussels

Hard and Soft Substrates

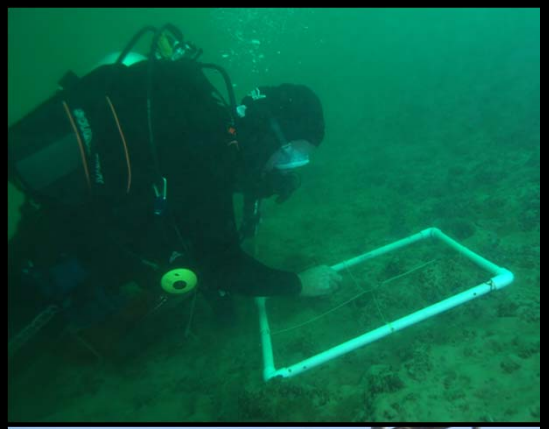
Ponar & SCUBA

Multiple locations throughout Lake Mead

Transect surveys

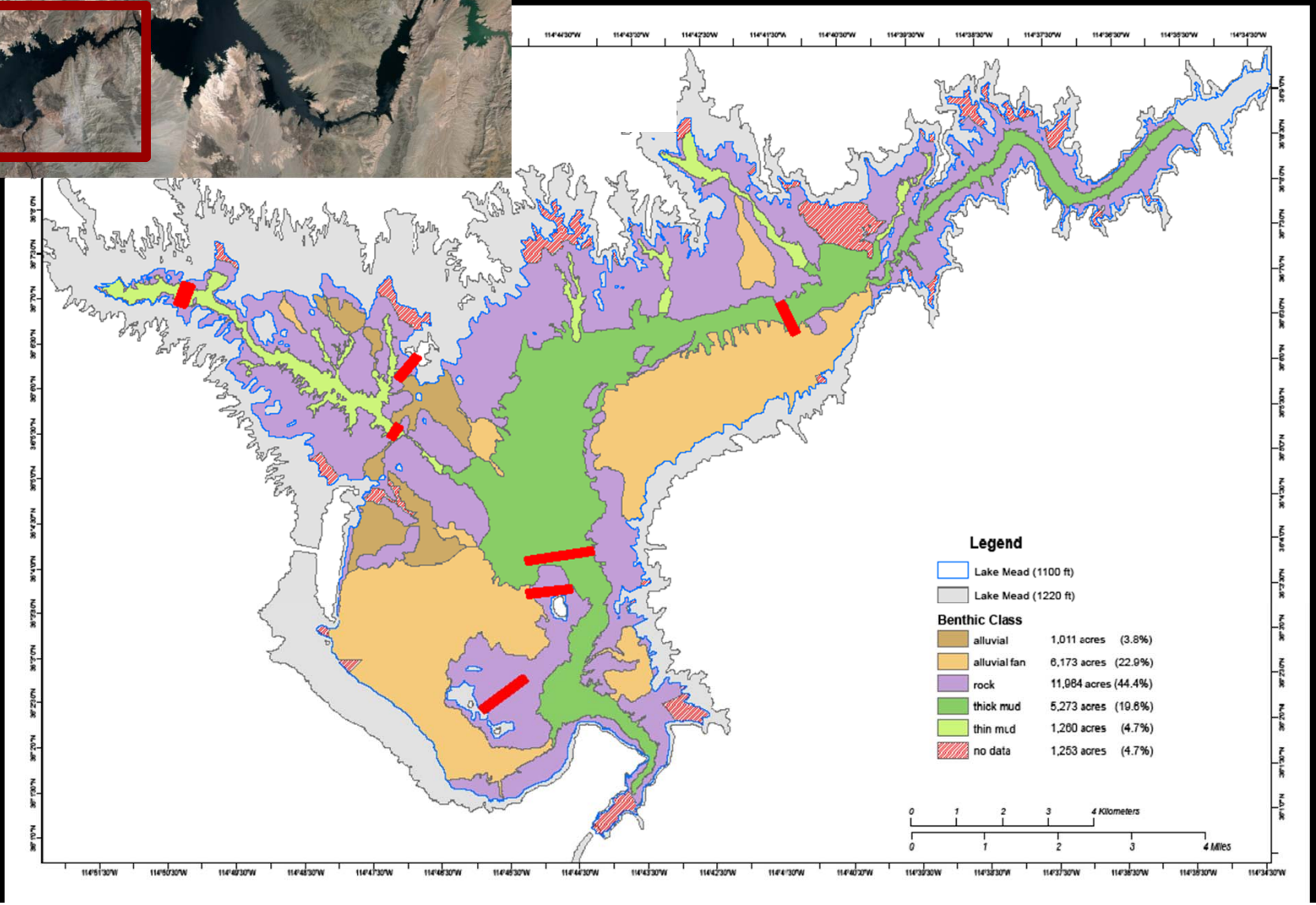
Began in 2007

Transect location and frequency for adult and juvenile mussels in Lake Mead

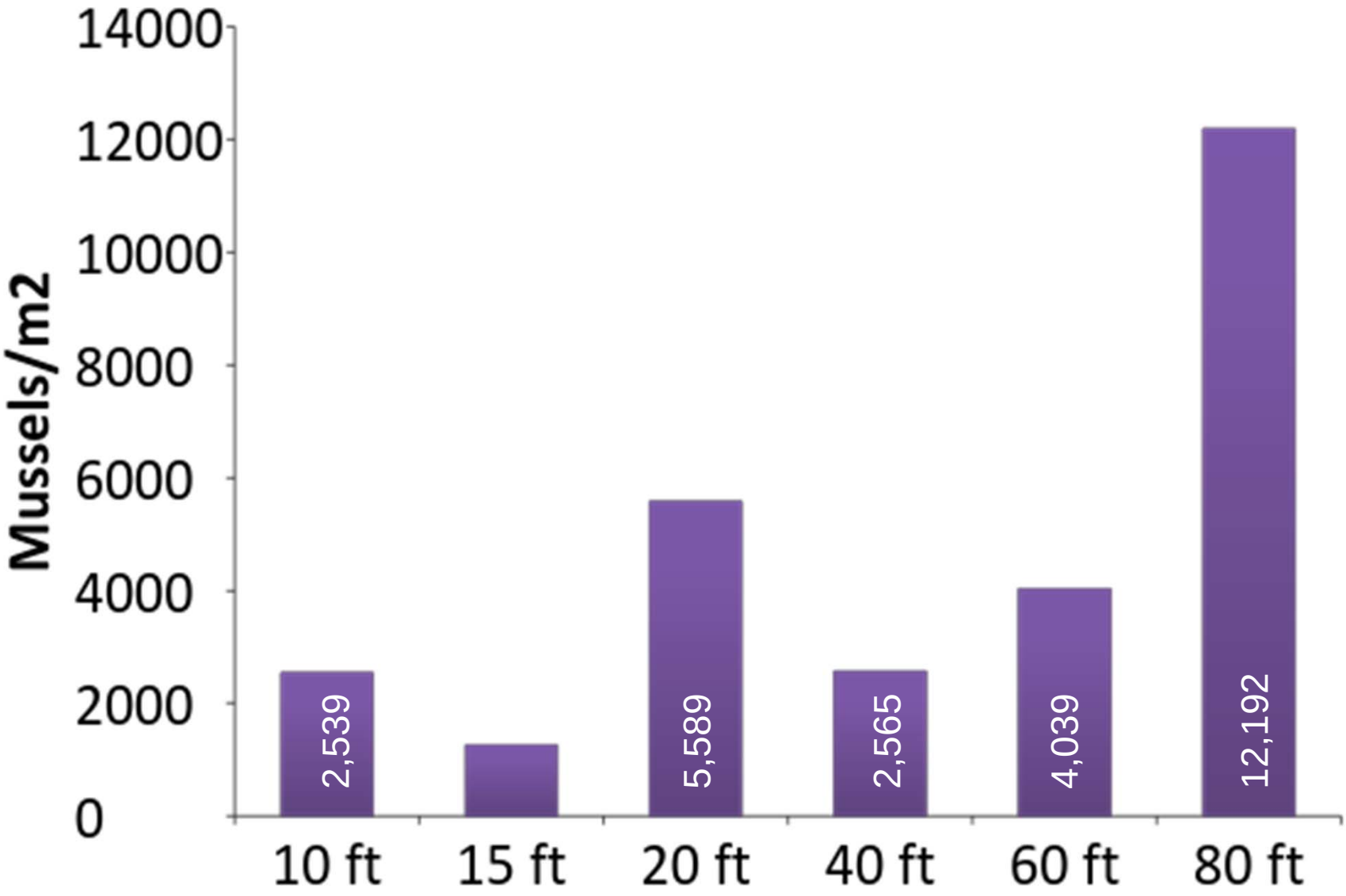


Station Name	Substrate	Sampling	Frequency
CR 346.4	Soft	Grab	Quarterly
LVB 7.3	Soft	Grab	Quarterly
LVB 3.5	Soft	Grab	Quarterly
CR351.7	Soft	Grab	Quarterly
Overton Arm	Soft	Grab	Annual
Virgin Basin	Soft	Grab	Annual
Temple Bar	Soft	Grab	Annual
Greg Basin	Soft	Grab	Annual
Sentinel Island	Hard	Diving	Quarterly
Black Island	Hard	Diving	Quarterly
Boulder Island	Hard	Diving	Quarterly
The Temple	Hard	Diving	Annual
Sandy Point	Hard	Diving	Annual

Quagga Mussel Monitoring
Boulder Basin



Density In Black Island - October 2009



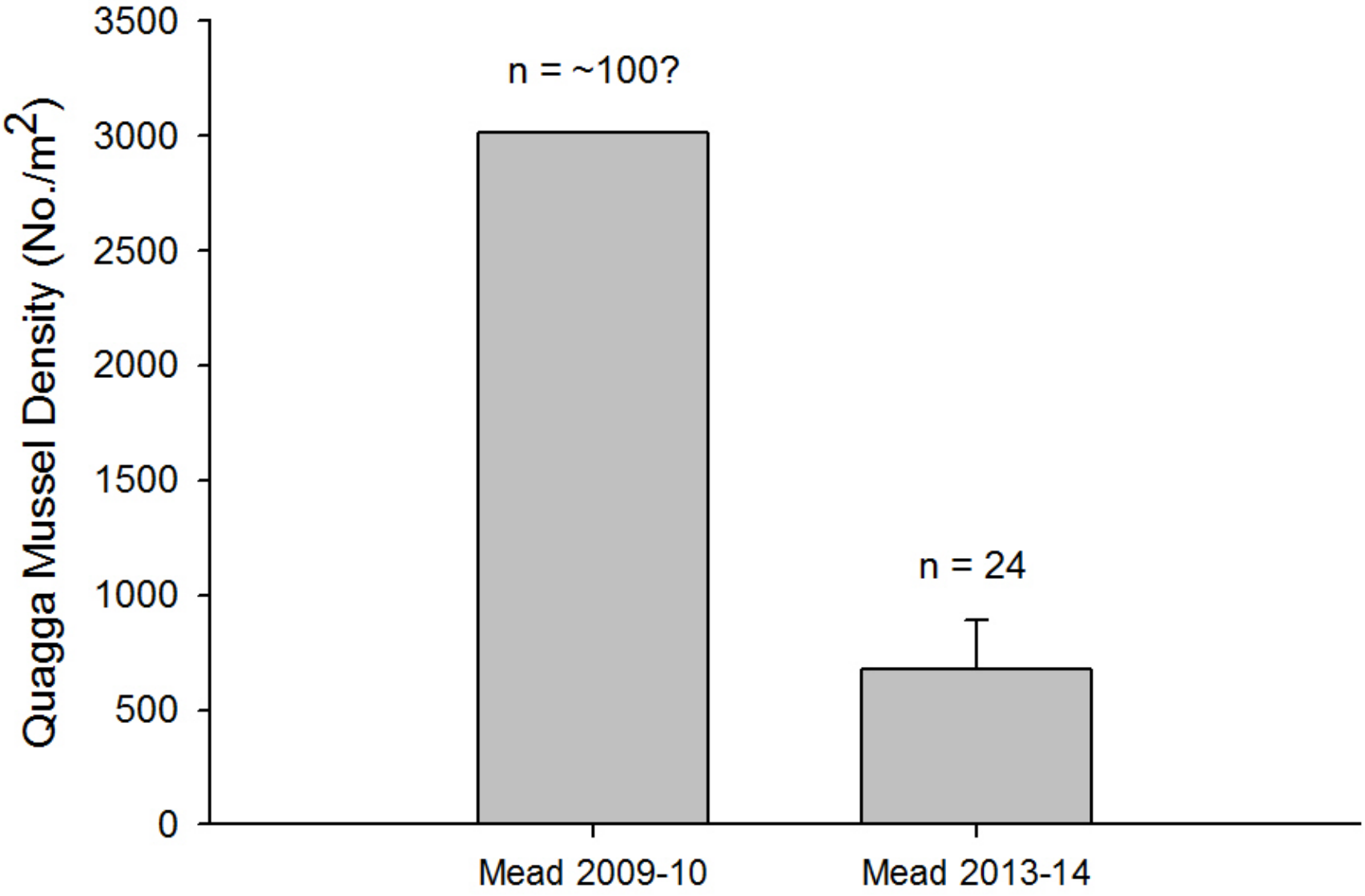
Density In Black Island

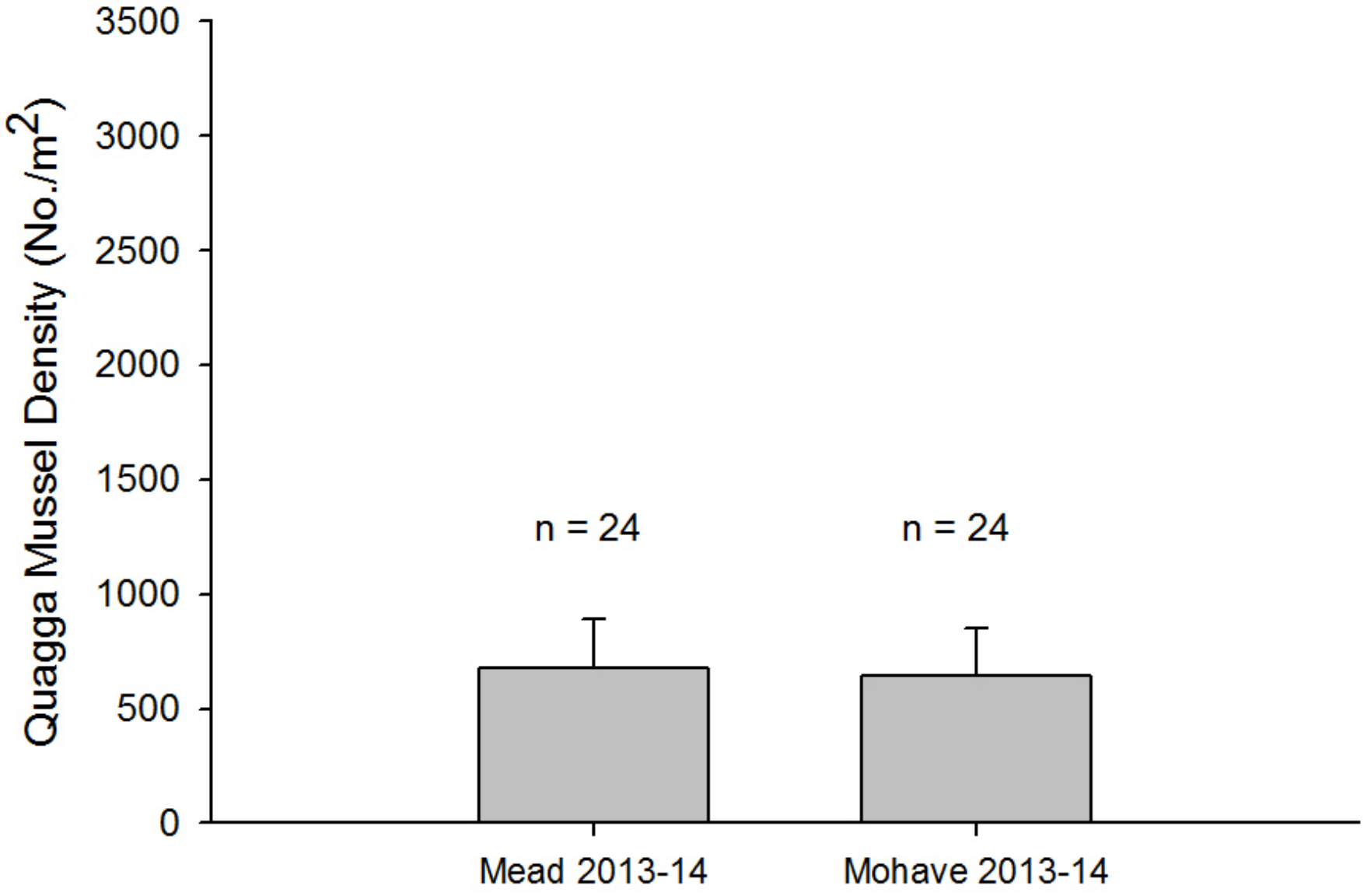
Depth (ft)	June 2007 Ind/m²	October 2009 Ind/m²	Change (%)
40	93.6	2659.4	+ 2800%
60	656.8	4037.4	+ 600%

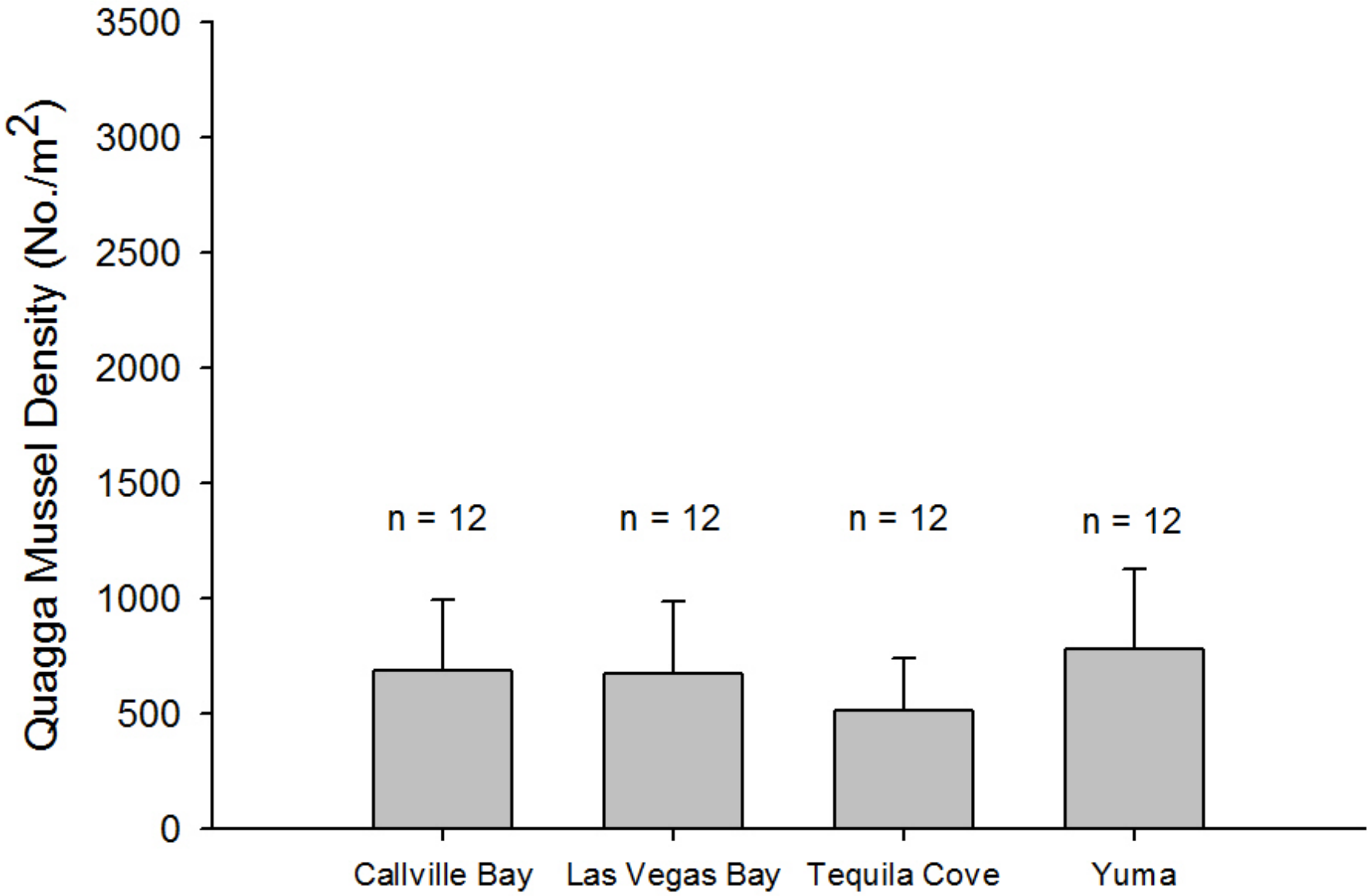
Mean Density In Hard Substrates 2007 vs. 2009

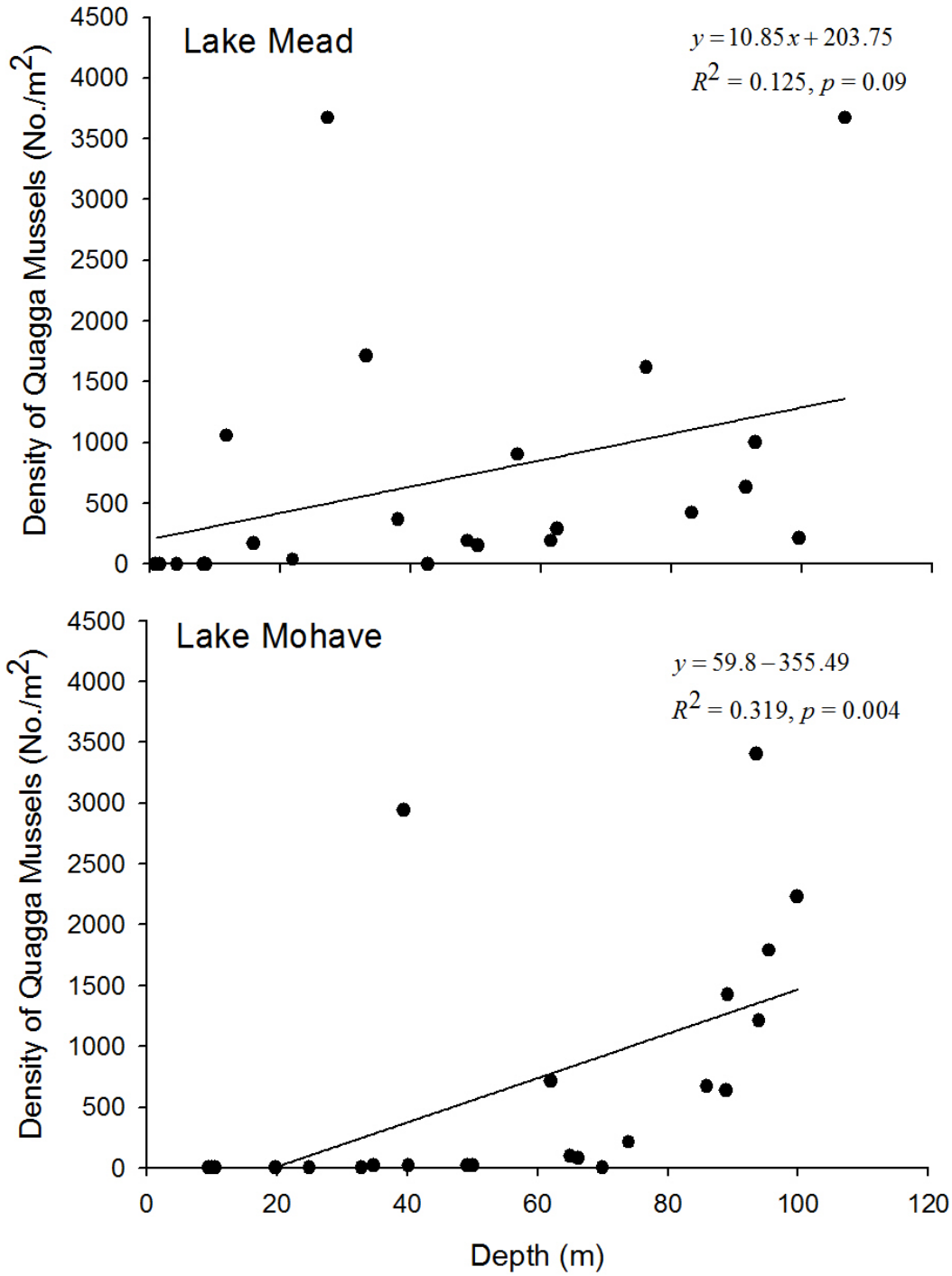
Time	2007	2009	Change (%)
Mussels/m^2	624 ± 707	4697 ± 3961	+ 753%
Samples	N = 108	N = 6	

MEAN DENSITY IN SOFT SUBSTRATES

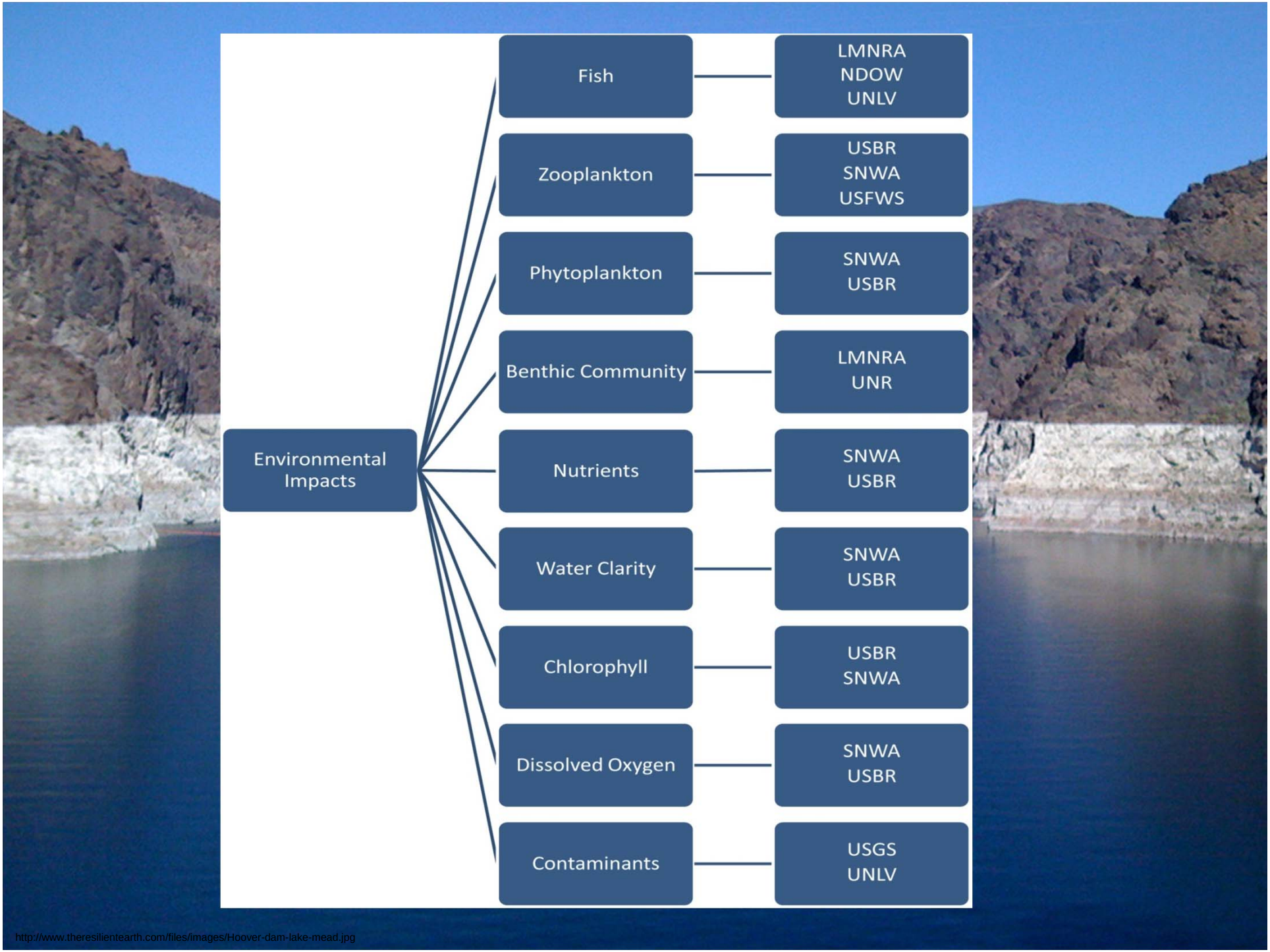



Quagga Mussel Density (No./m2)
3500
3000
2500
2000
1500
1000
500
0
n = 24
n = 24
Mead 2013-14
Mohave 2013-14


Quagga Mussel Density (No./m2)
3500
3000
2500
2000
1500
1000
500
0
n = 12
n = 12
n = 12
n = 12
Callville Bay
Las Vegas Bay
Tequila Cove
Yuma


Lake Mead
$y = 10.85x + 203.75$
$R^2 = 0.125, p = 0.09$
Density of Quagga Mussels (No./m^2)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Lake Mohave
$y = 59.8 - 355.49$
$R^2 = 0.319, p = 0.004$
Density of Quagga Mussels (No./m^2)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
Depth (m)

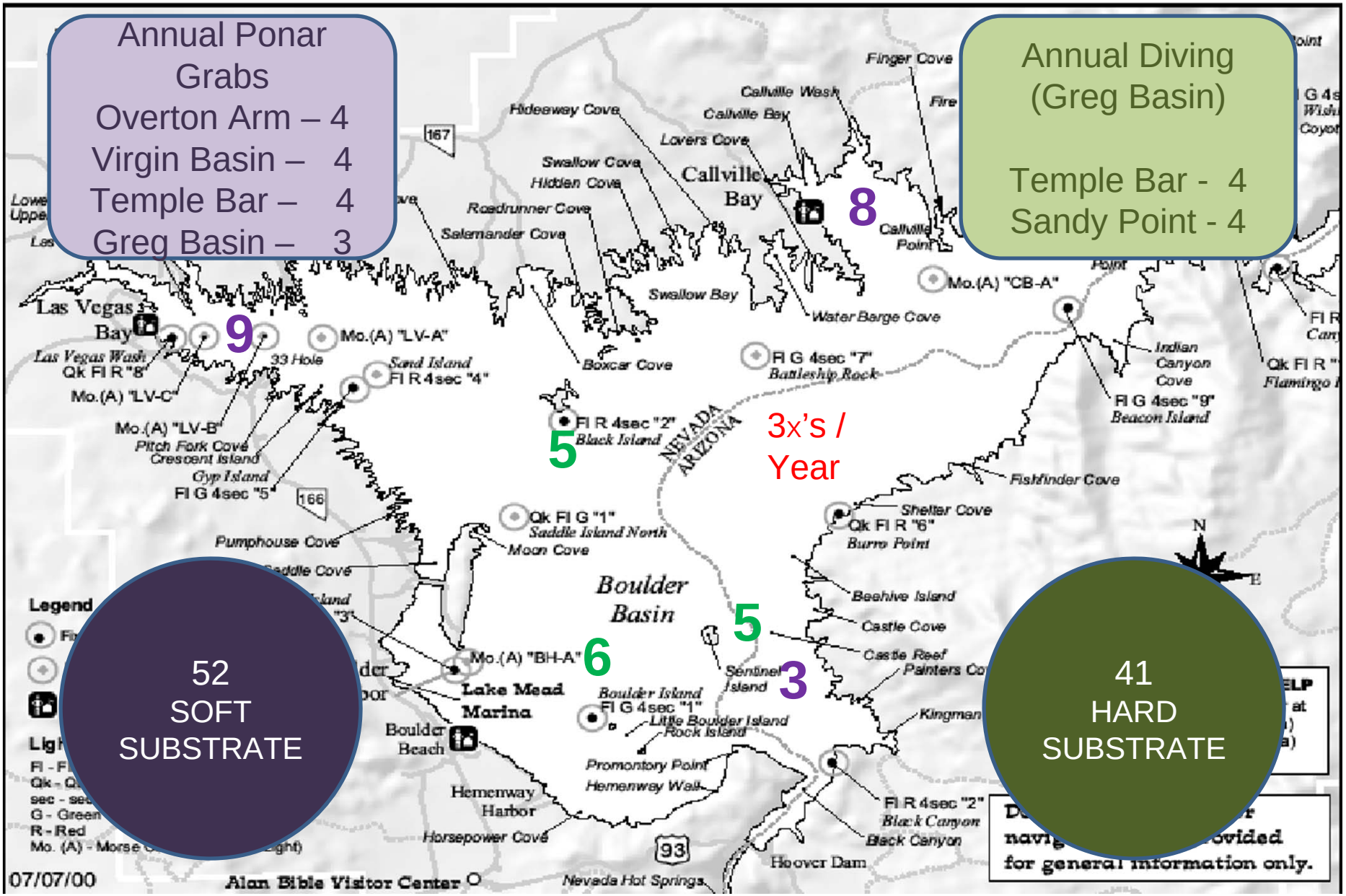
Questions?
starcasm.net



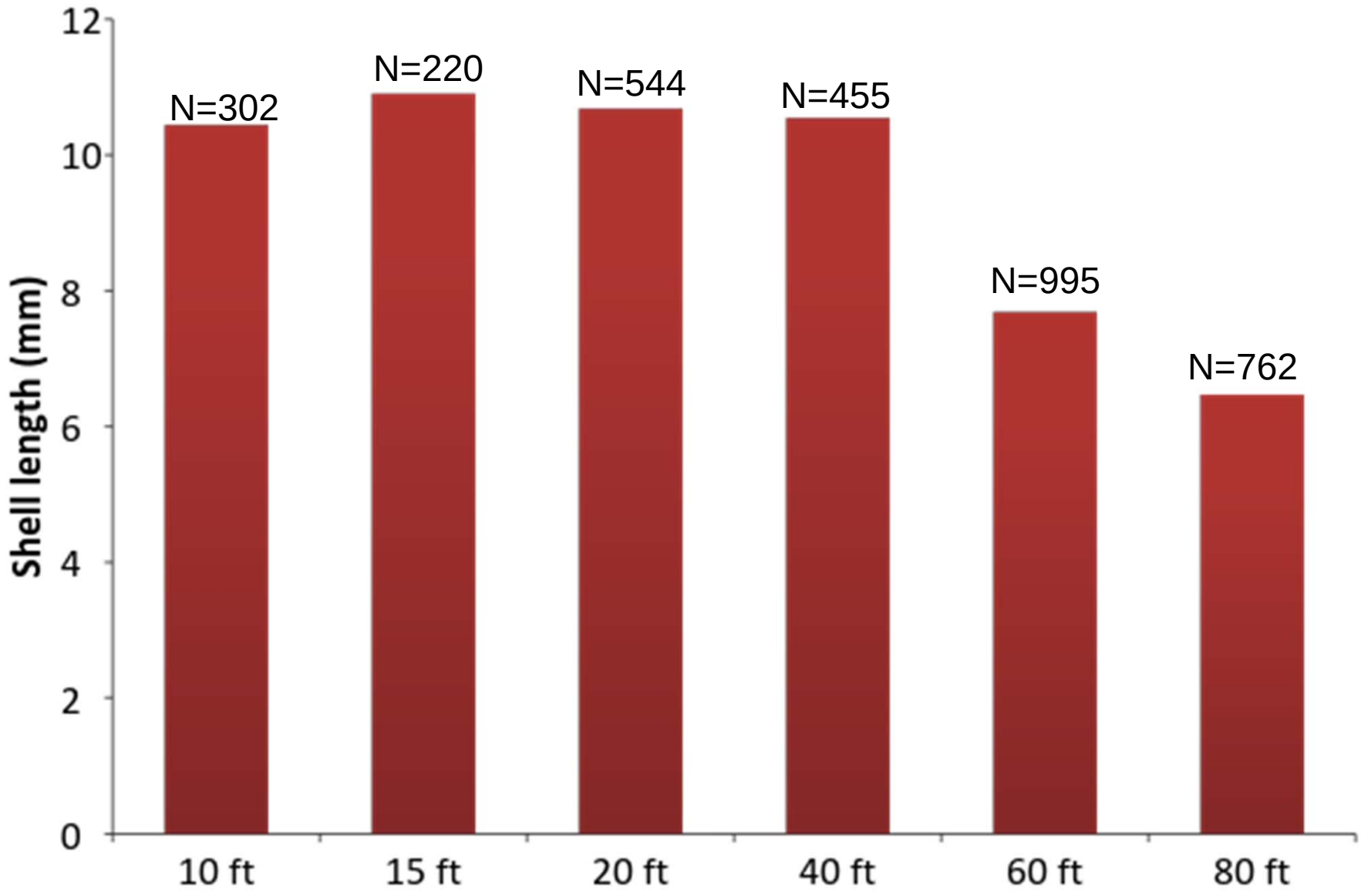
http://www.theresilientearth.com/files/images/Hoover-dam-lake-mead.jpg

I-MAP UPDATE – FALL 2009 / SPRING 2010

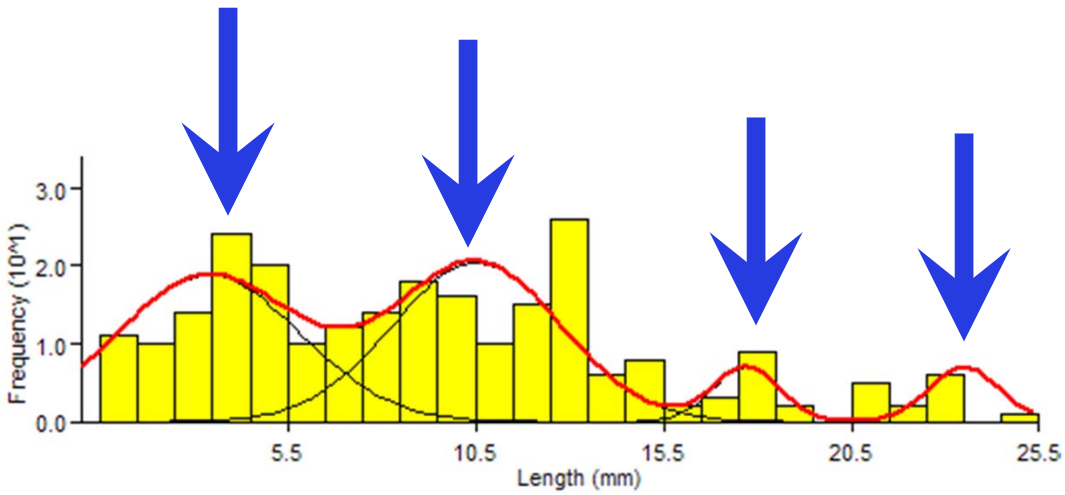
(Interagency Monitoring Action Plan on Quagga Mussels)



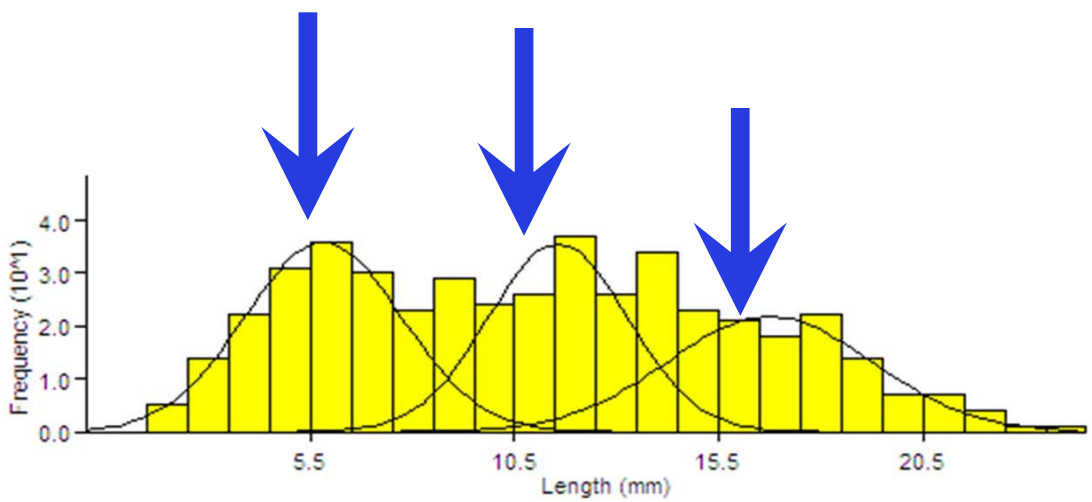
Mussel Size


Shell length (mm)
12
10
8
6
4
2
0
N=302
N=220
N=544
N=455
N=995
N=762
10 ft
15 ft
20 ft
40 ft
60 ft
80 ft

BLACK ISLAND: Length Frequency

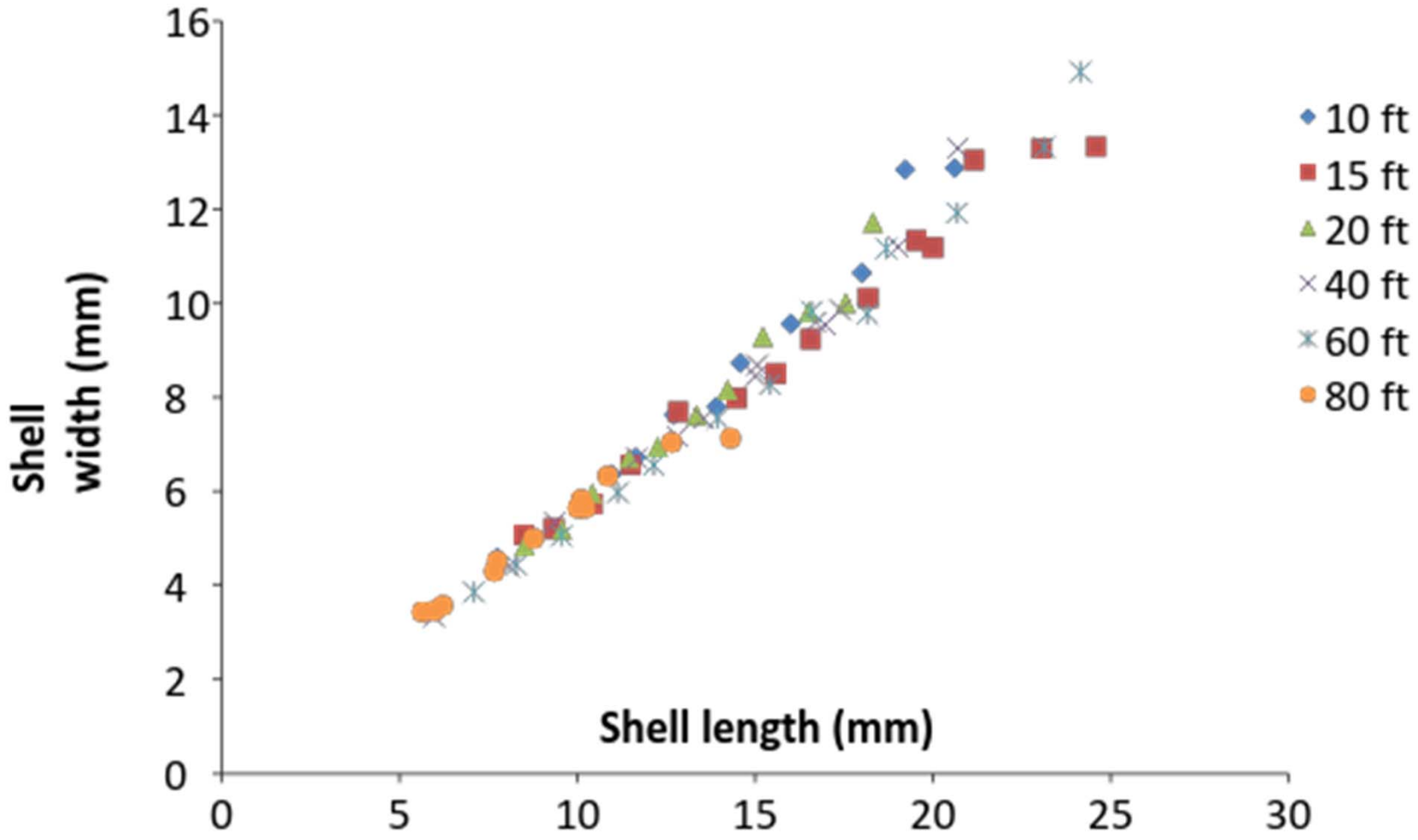


March 26, 2007 (50ft)

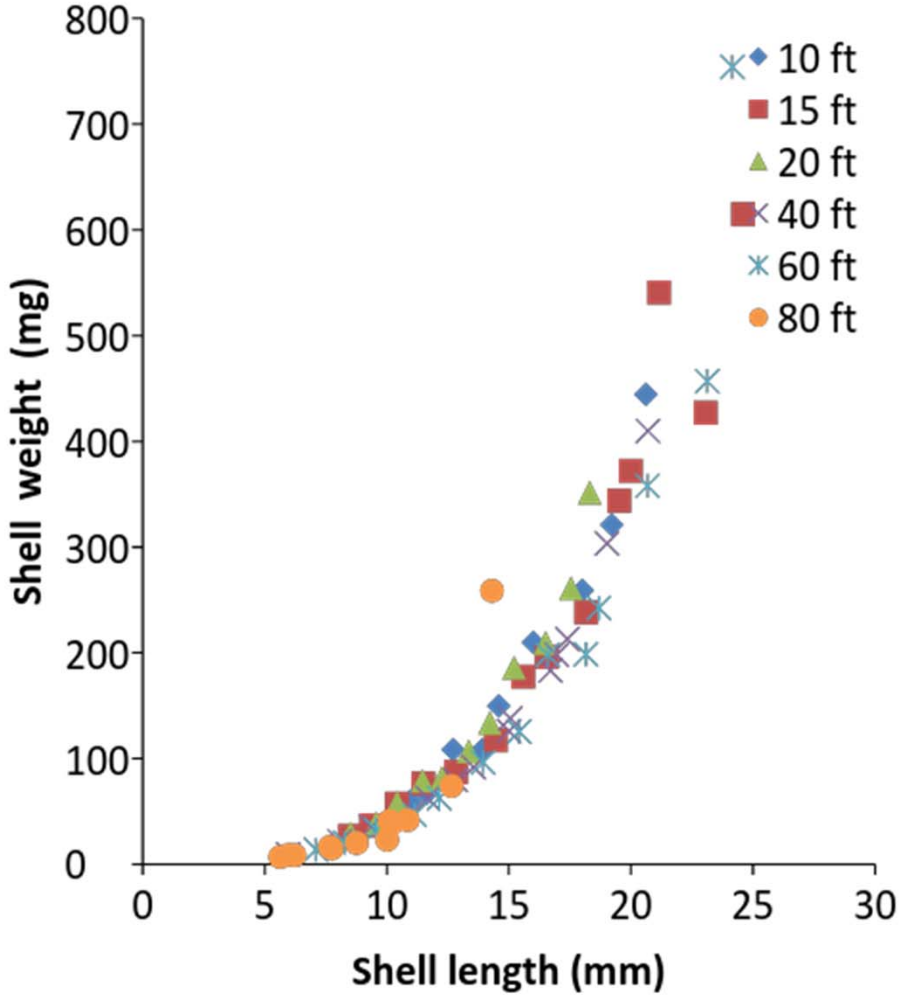


October 29, 2009 (40ft)

Relationship Between Length & Width



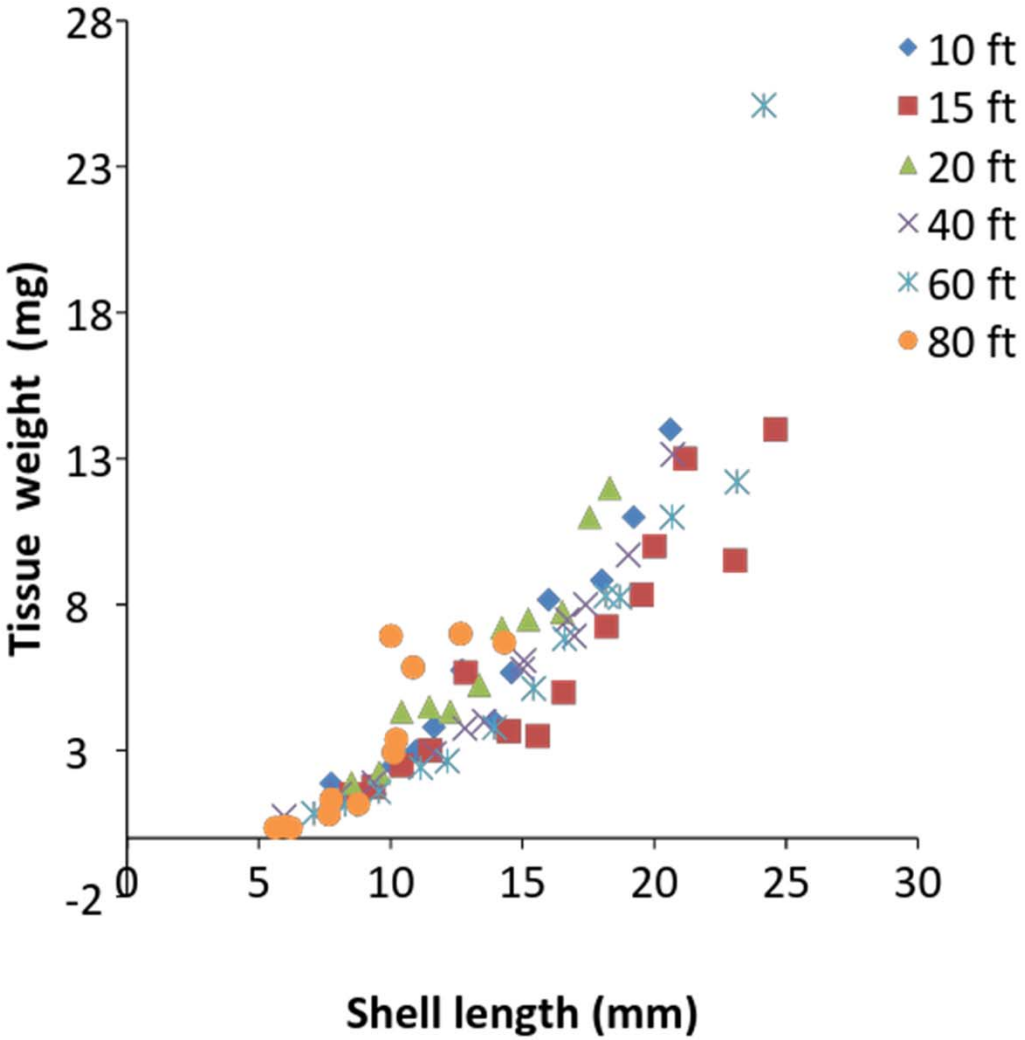
Shell Length vs. Shell Weight



Analysis of Covariance

Depth is <u>not</u> a significant factor that affects shell weight.

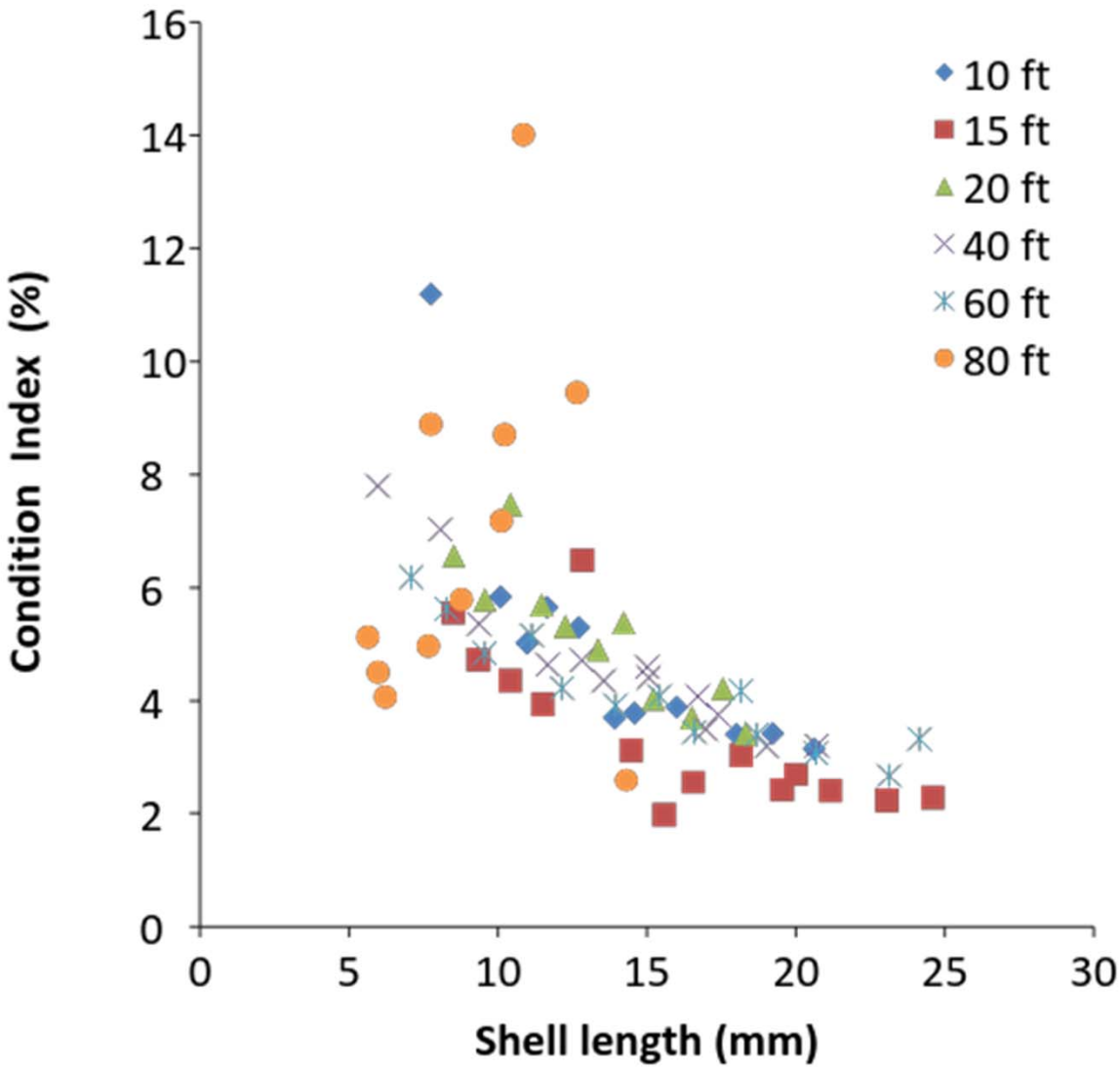
Tissue Weight vs. Shell Length



Analysis of Covariance

Depth is <u>not</u> a significant factor that affects tissue weight.

NUTRITIONAL STATUS



Analysis of Covariance

Depth is a significant factor that affects nutritional status.

Mussels collected from 80 ft had higher condition index.