

# Use of ultrasonic imaging to evaluate egg maturation of humpback chub *Gila cypha* in Grand Canyon

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# Background





# Background

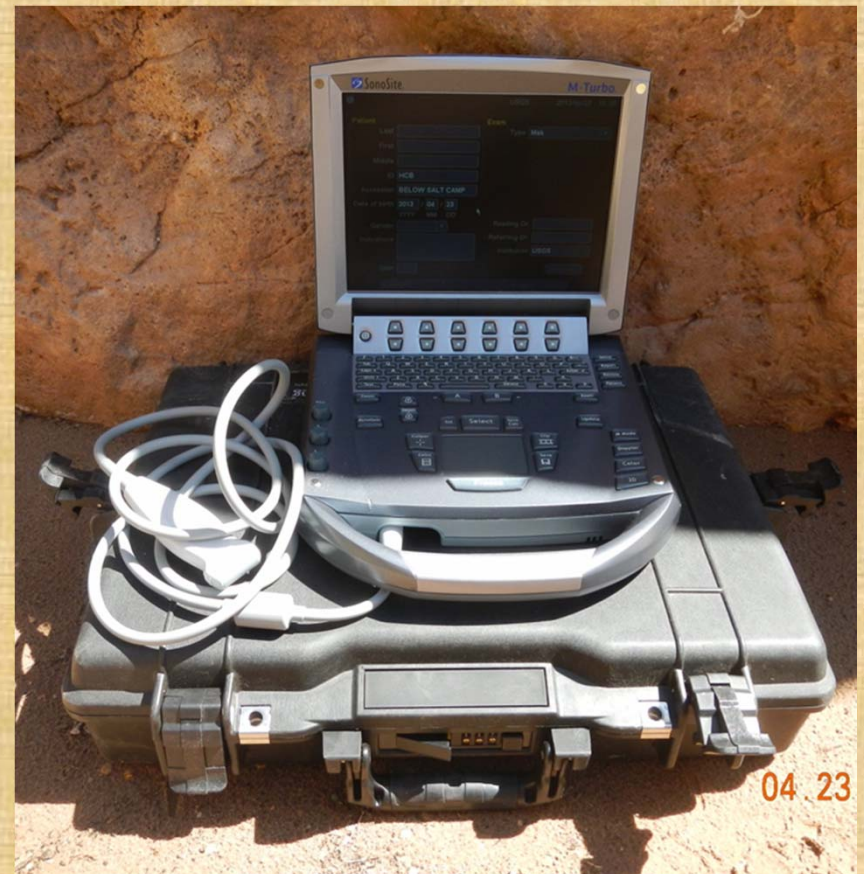


<http://www.uahealth.com/sites/default/files/Ultrasound%20Aprio-.png>



# Background

- Ultrasonic imaging
  - Non-lethal
  - Used to determine sex and ovarian maturity of variety of fishes
  - Not waterproof

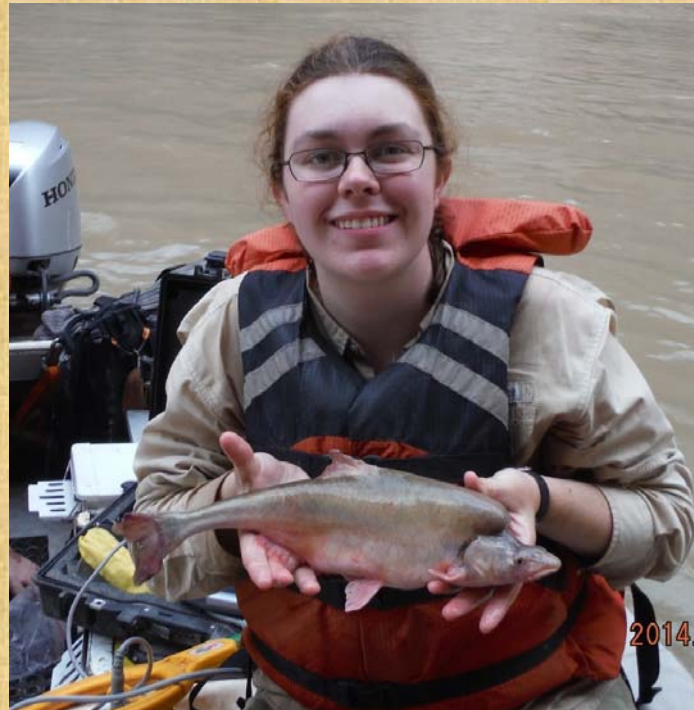


04.23



# Goals

- Evaluate use of ultrasonic imaging to identify egg development in humpback chub
- Document locations of humpback chub egg maturation in the Grand Canyon





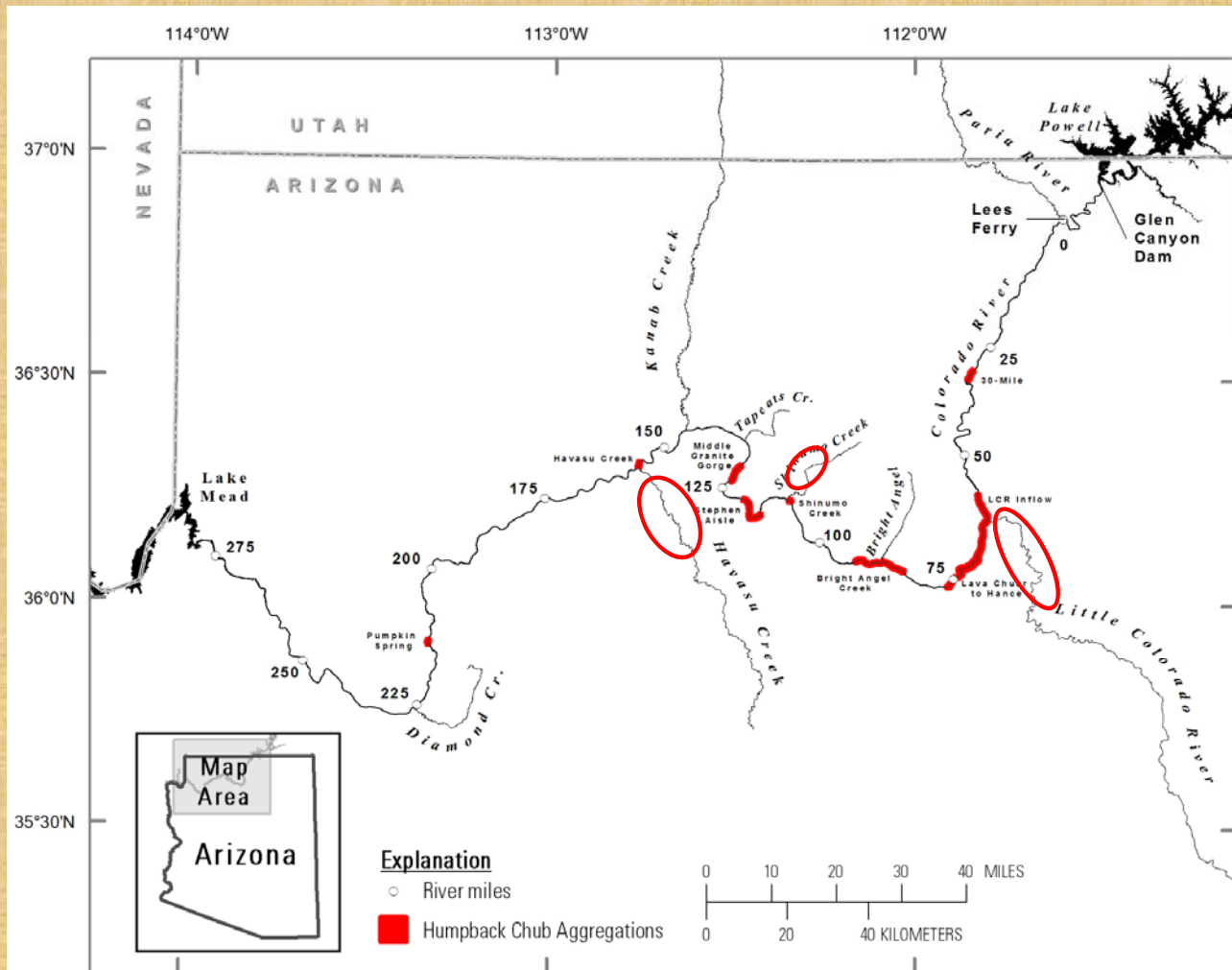
# Objectives

- Determine if ultrasonic imaging can be used to:
  - Identify eggs
  - Identify level of egg maturity
- Evaluate reproductive condition of humpback chub in:
  - Colorado River aggregations
  - Little Colorado River
  - Shinumo Creek
  - Havasu Creek





# Sample Locations



Map courtesy  
of Thomas  
Gushue,  
USGS

# Methods





# Methods





# Methods



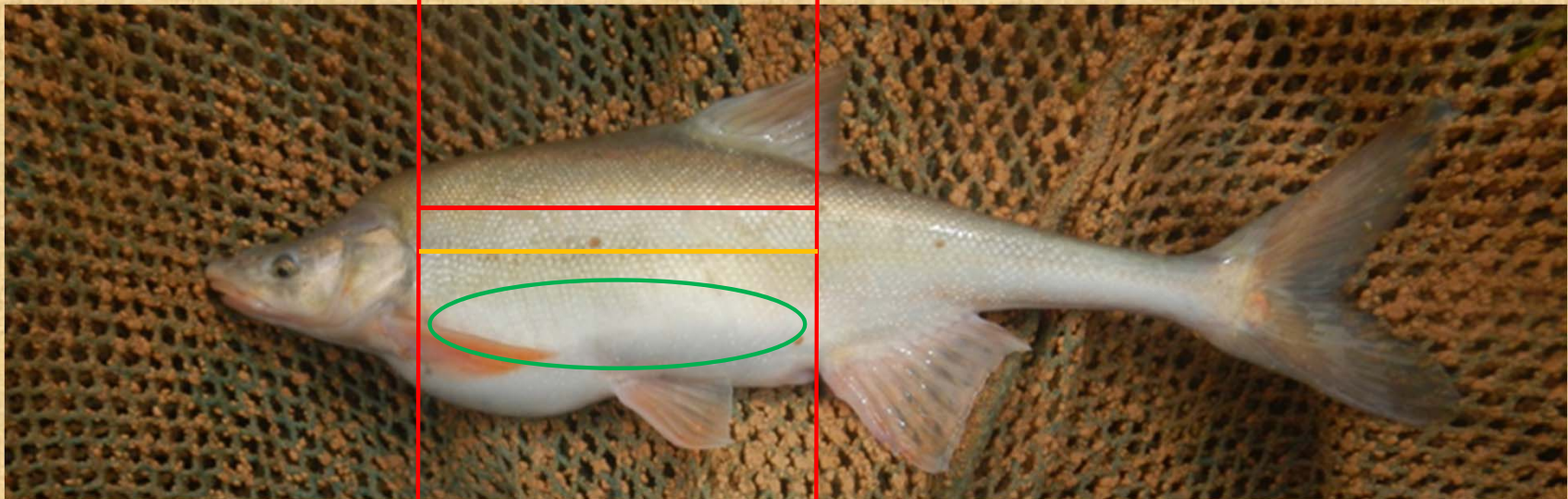


# Methods





# Methods



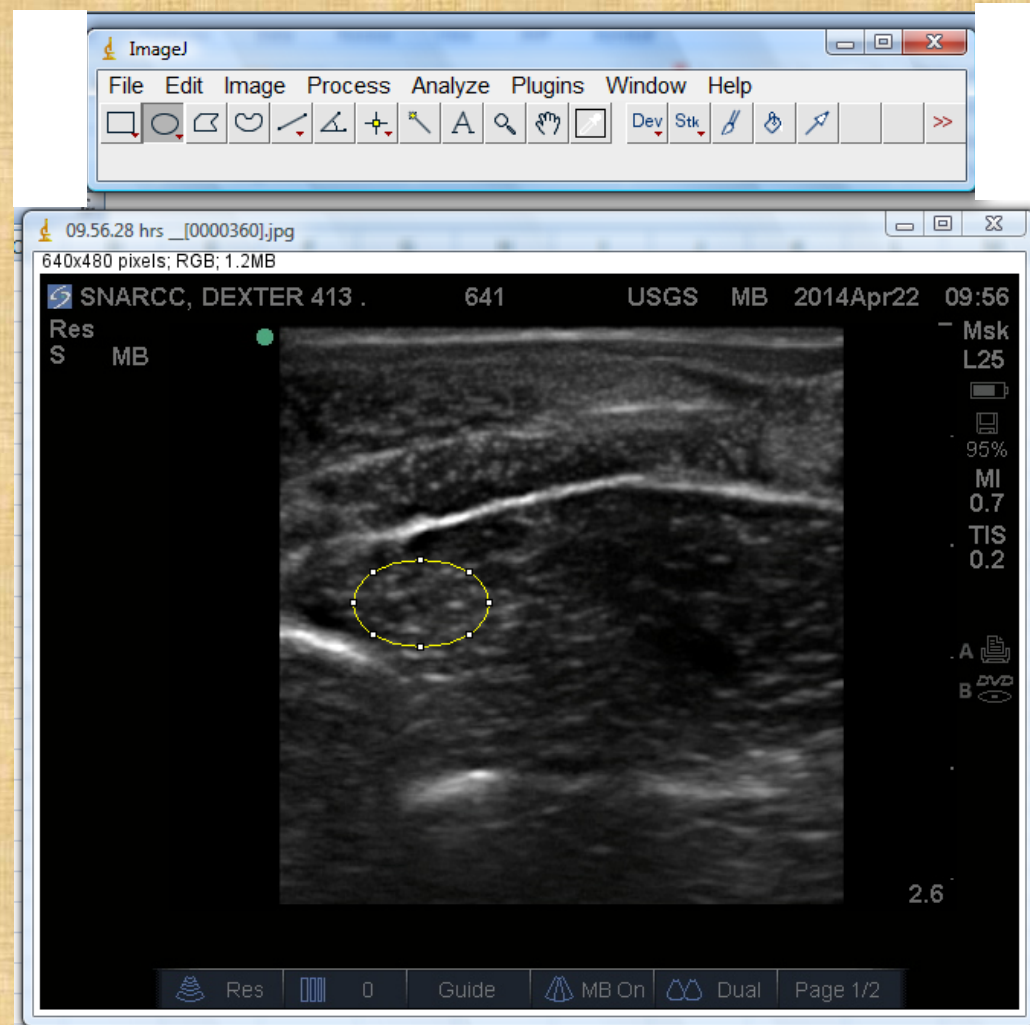


# Methods



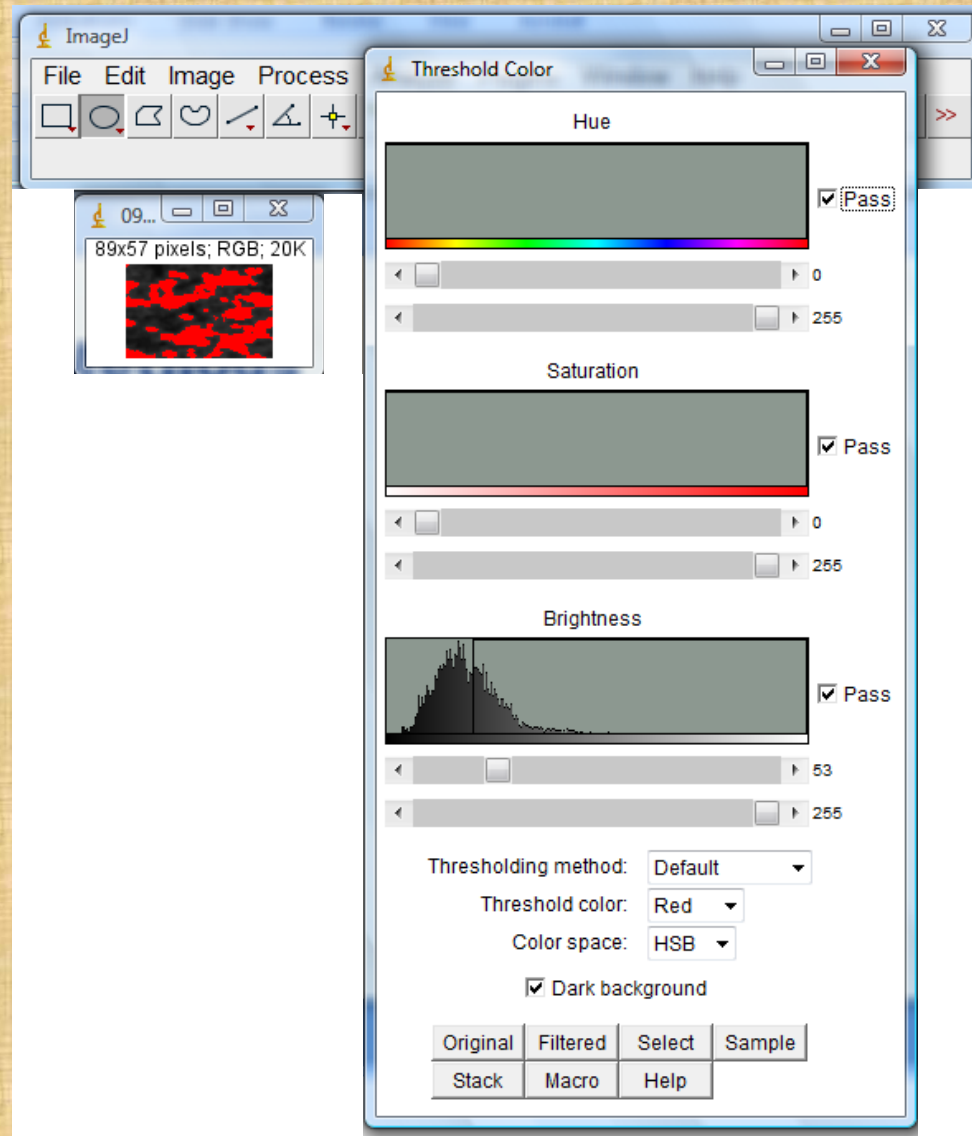


# Methods





# Methods





## Results-Lab Data

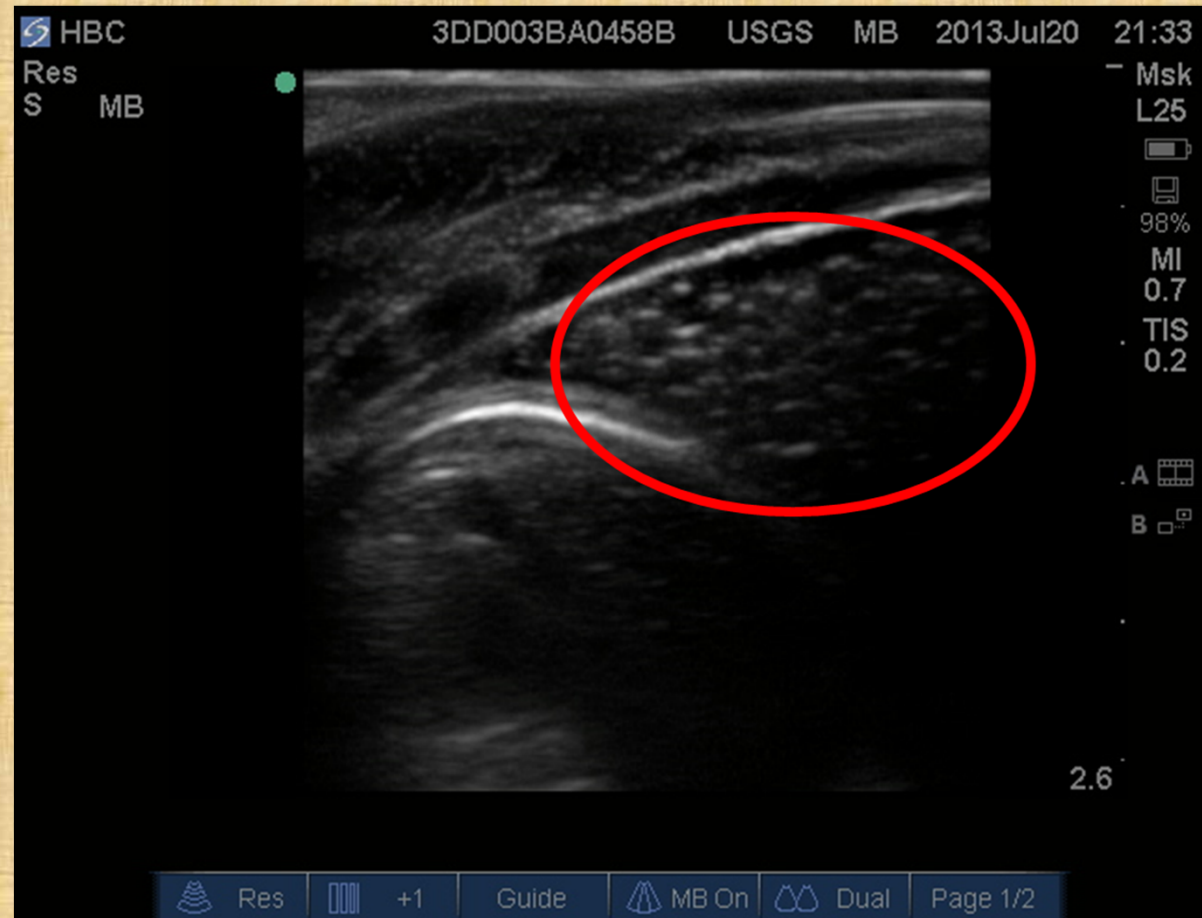
- Common carp ranged from 230-424 mm total length (N=58)
  - Mix of males and females
  - Some ripe males and 3 ripe females
- Correctly identified 78% of common carp
  - 2 females misidentified as males
  - 4/13 fish misidentified were ripe males





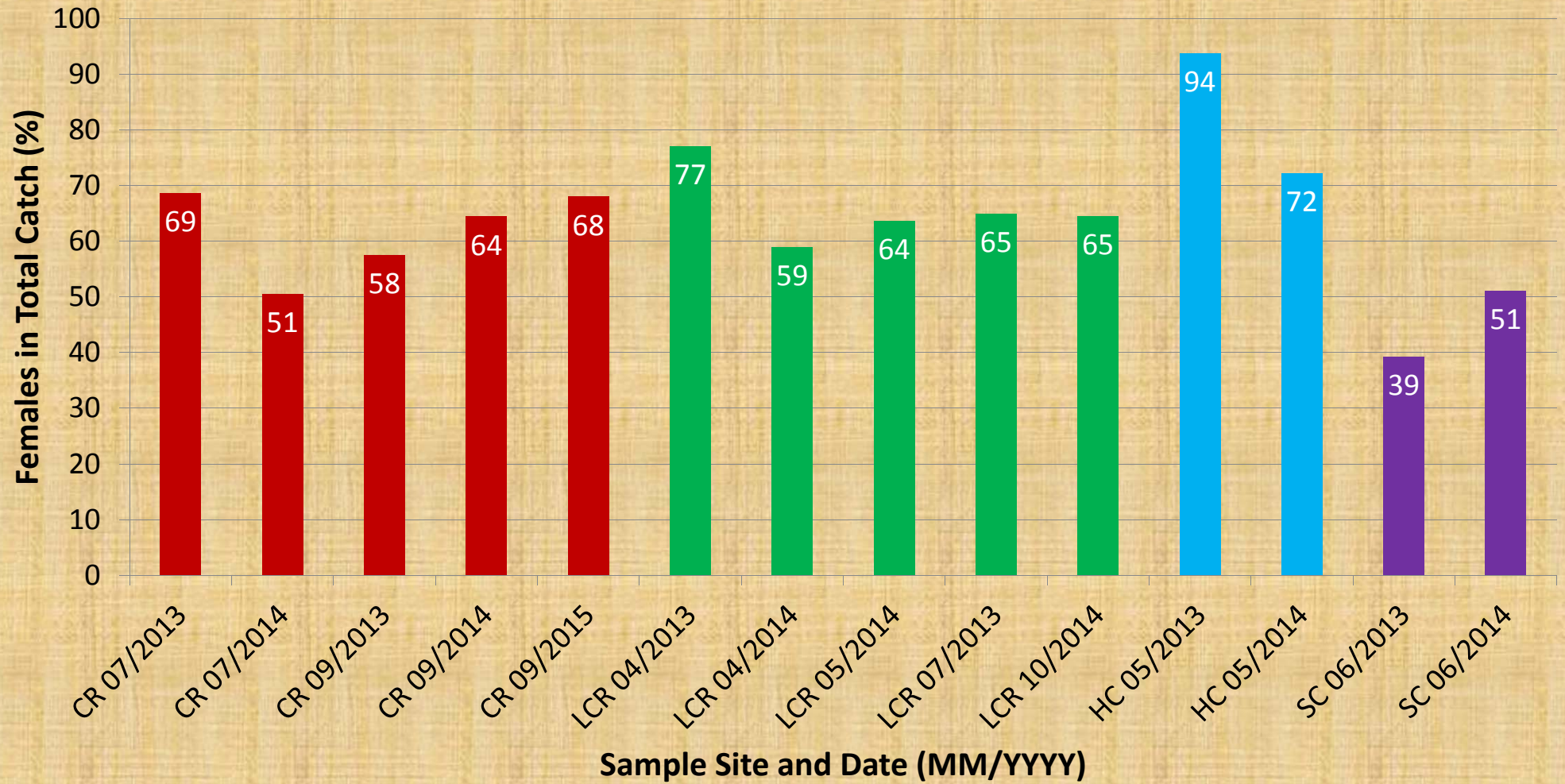
# Results-Chub Egg Identification

- Identified egg development with ultrasonic imaging





## Presence of Females with Eggs

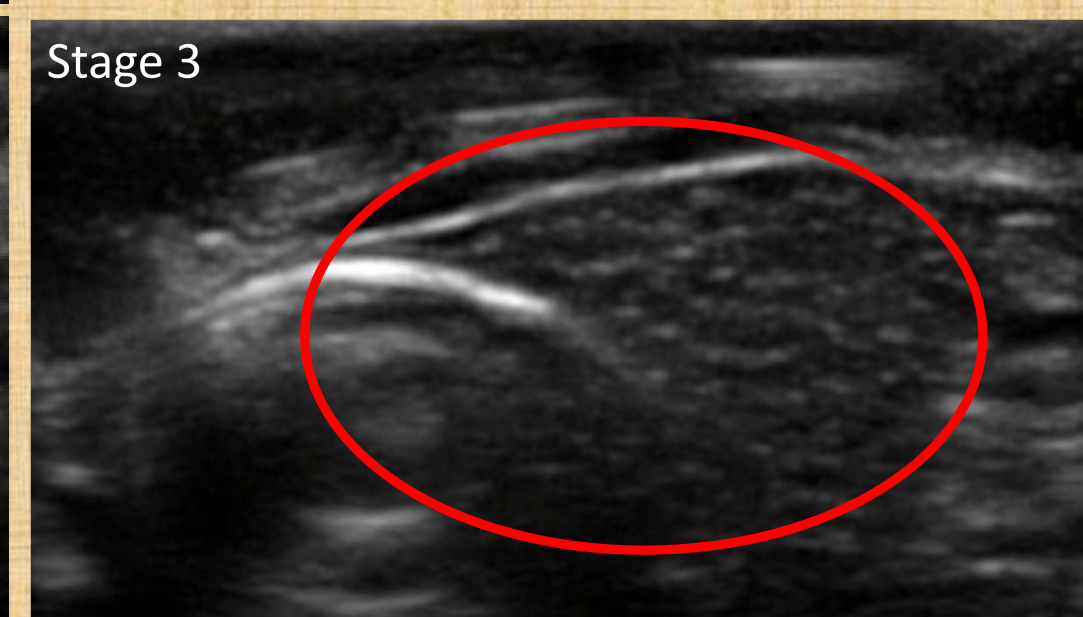
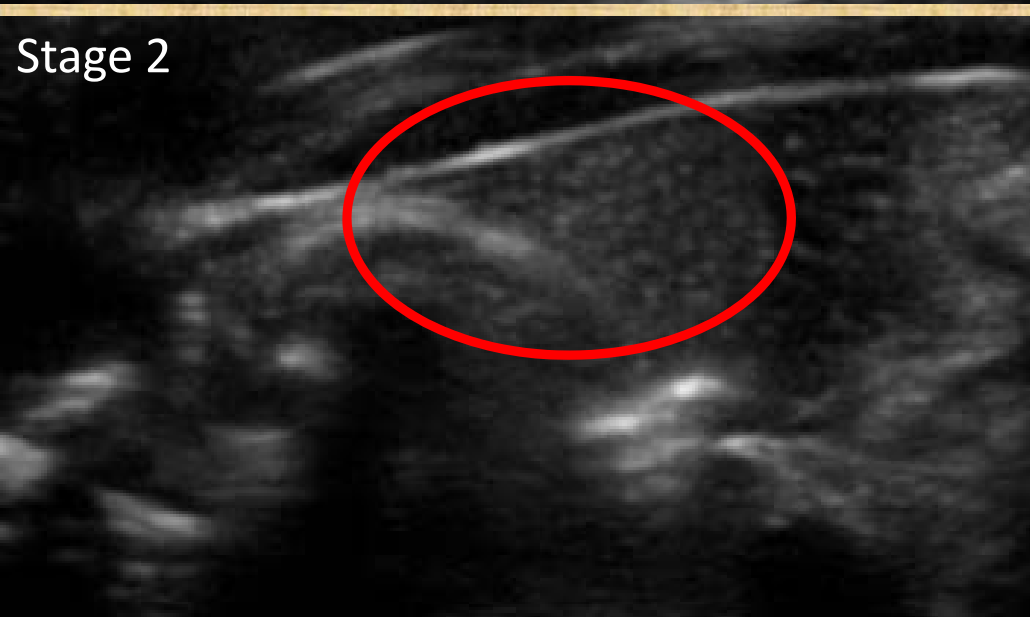
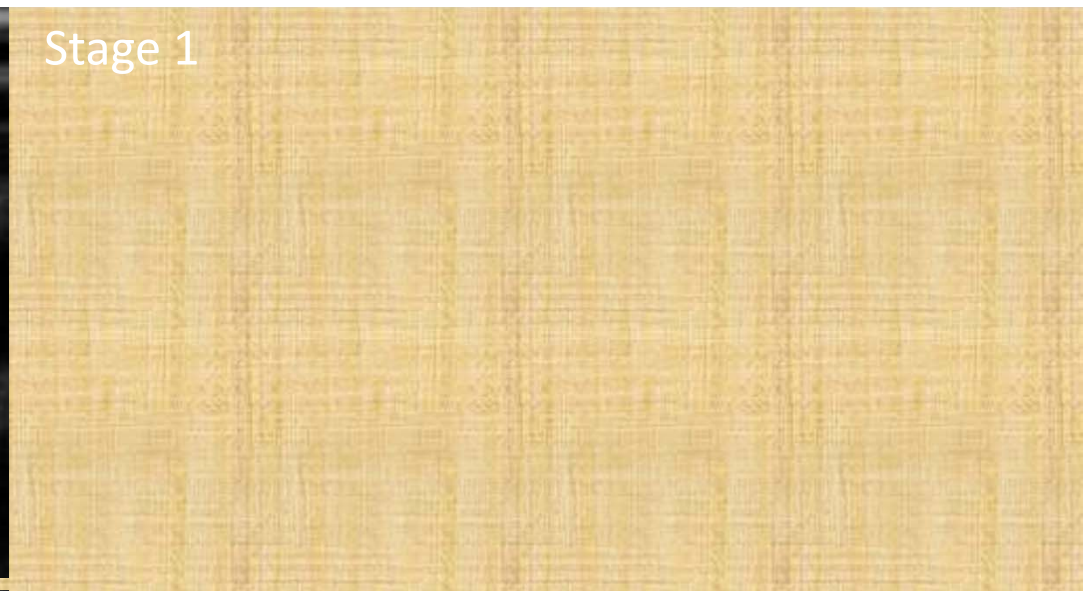
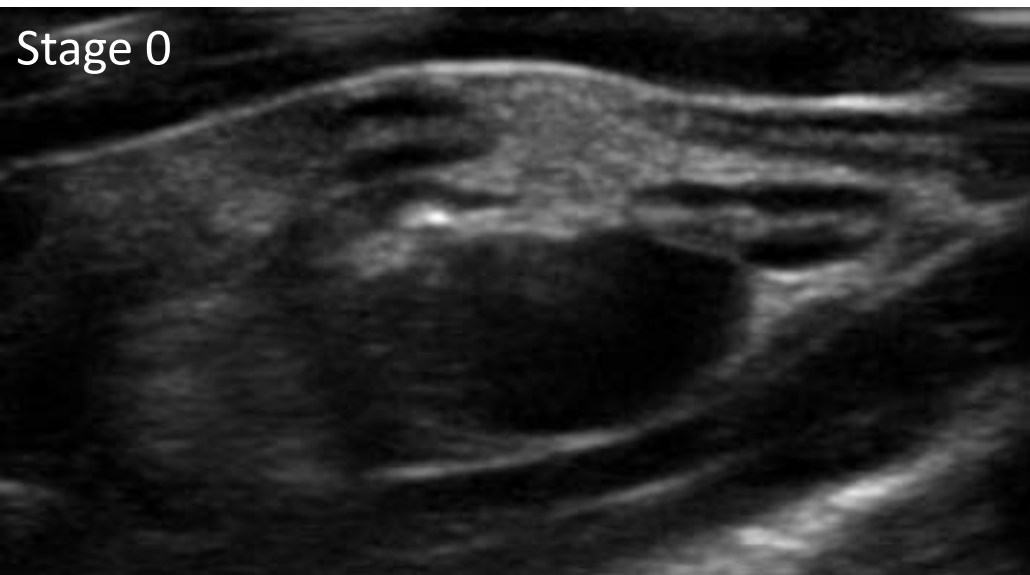




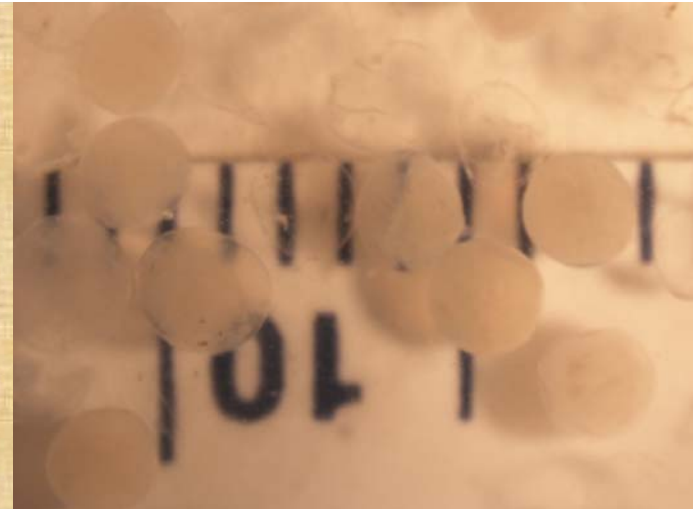
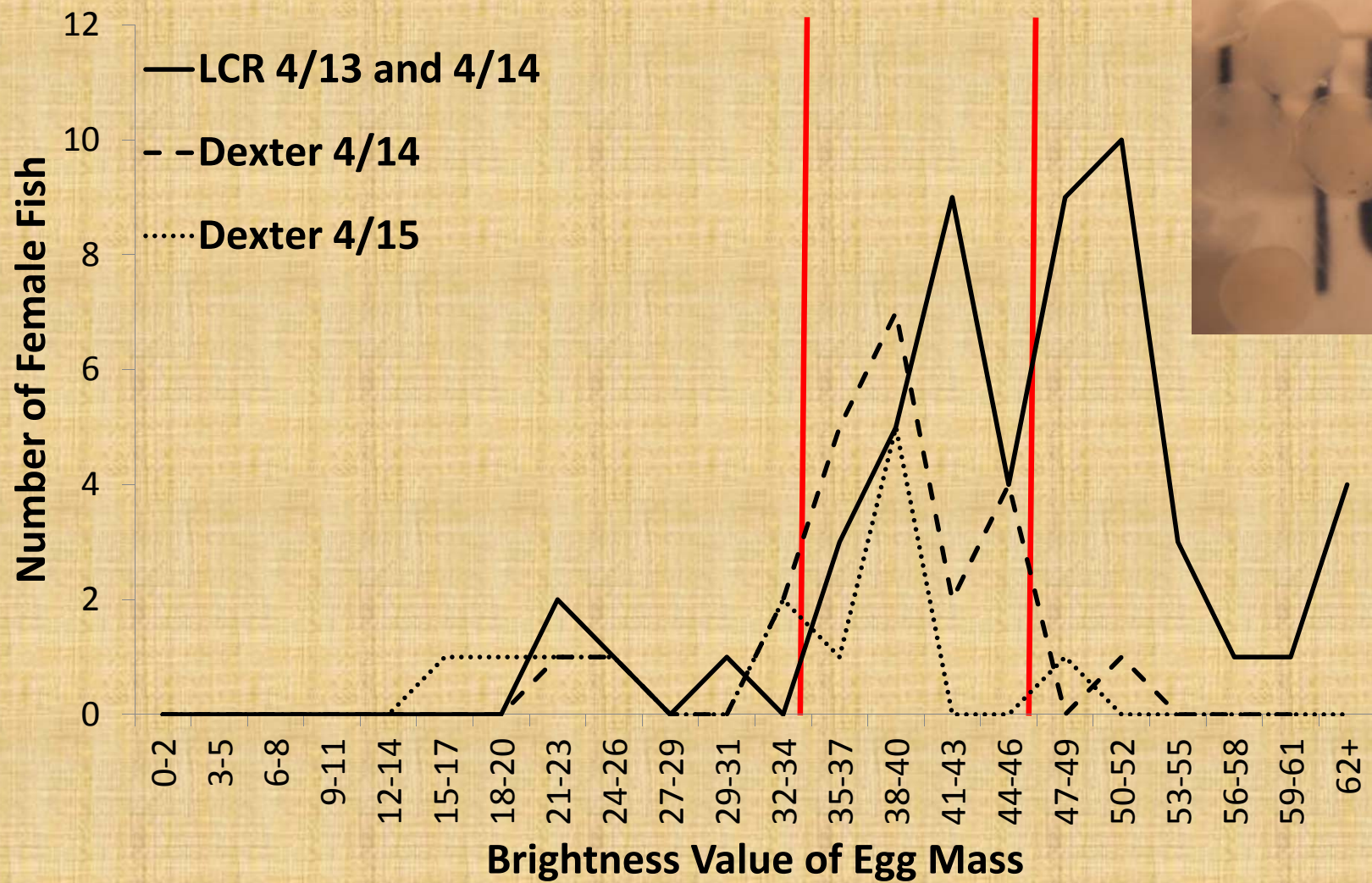
# Results-Different Levels of Egg Development

- Stage 0
    - No ovary lining present
  - Stage 1
    - Ovary lining present
    - Small mass of eggs
    - Low density of eggs (dark)
  - Stage 2
    - Ovary lining present
    - Small to medium mass of eggs
    - High density of eggs (bright)
  - Stage 3
    - Ovary lining present
    - Large mass of eggs
    - Dense bright centers surrounded by water
- Range 0-31
  - Range 45-100
  - Range 32-44





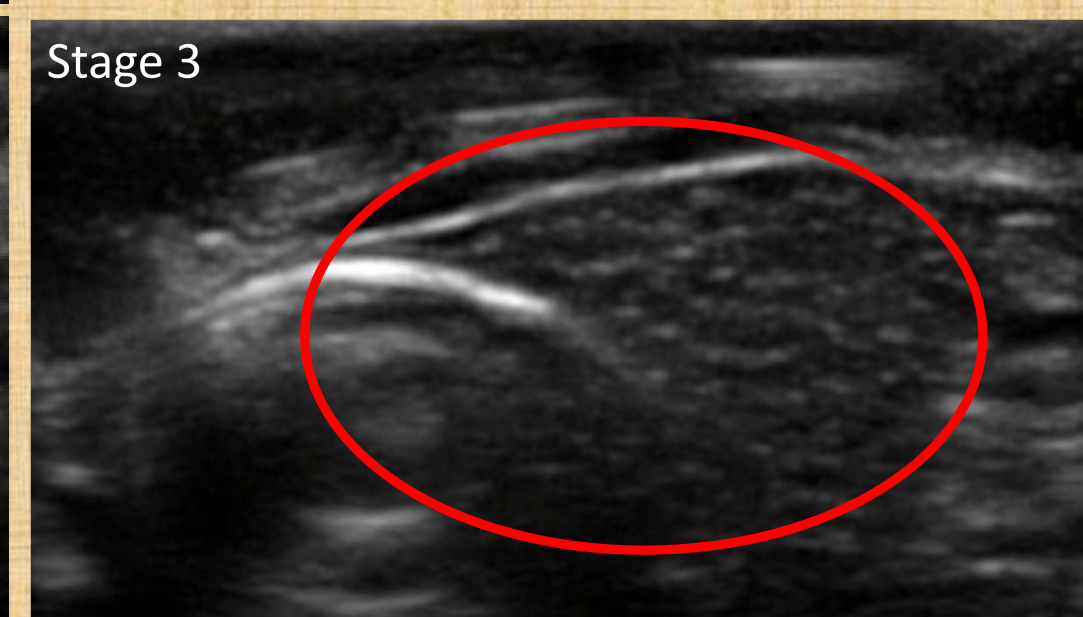
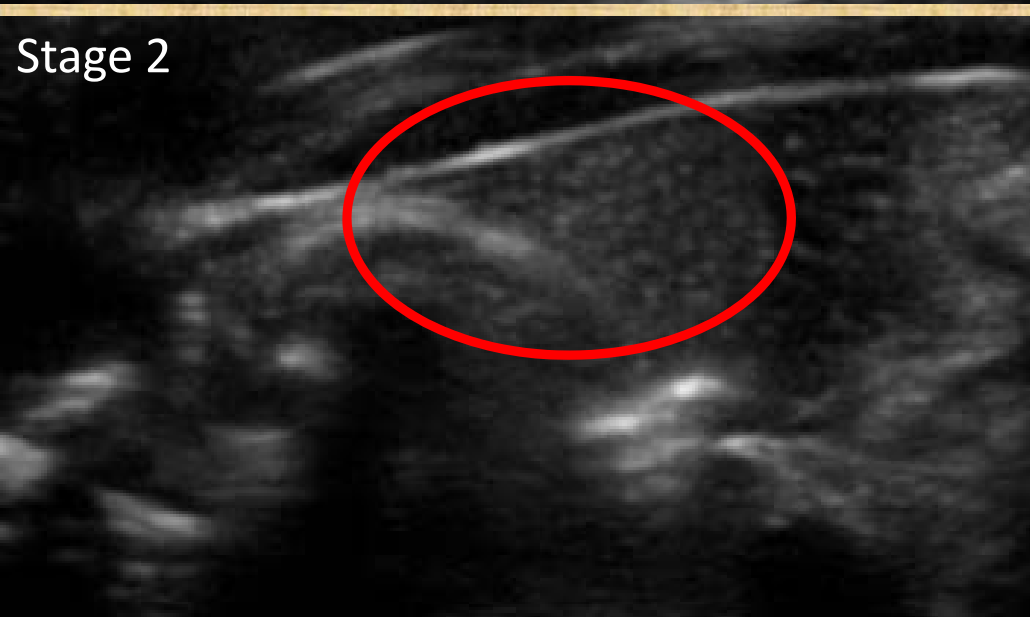
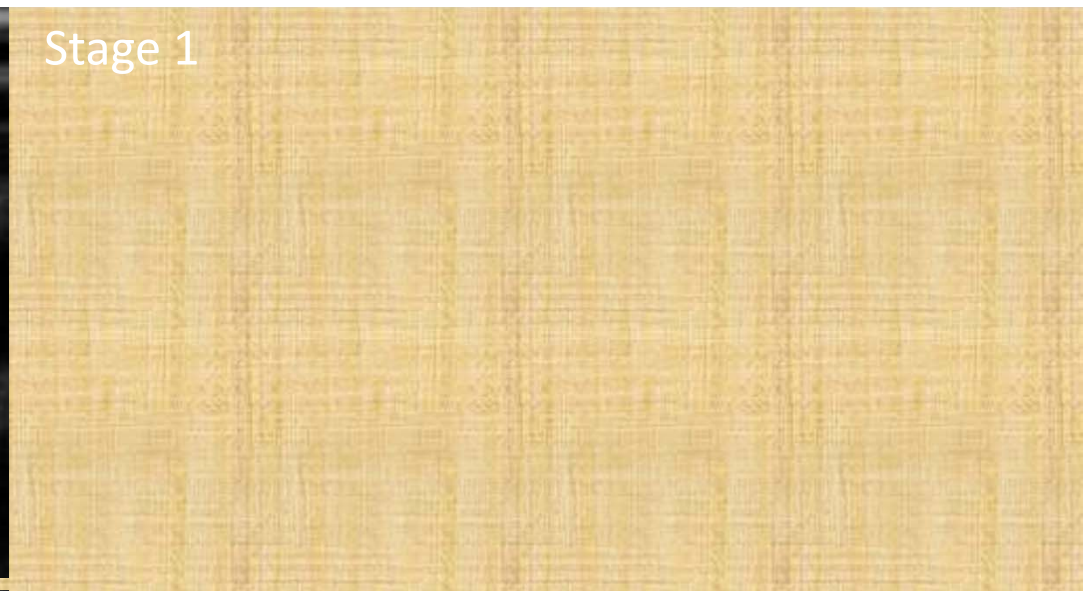
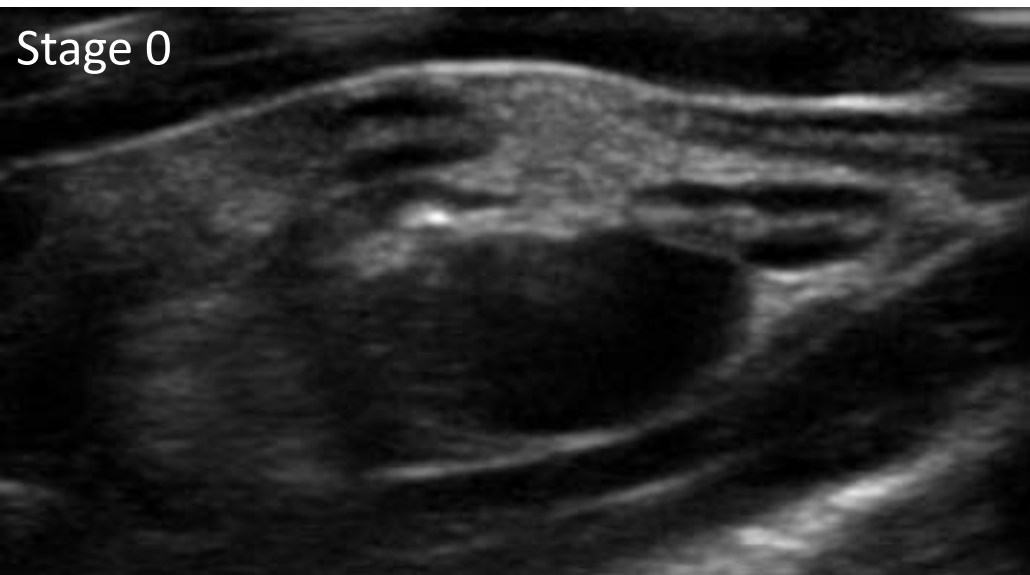






| Percentage of Ripe Females (No. Ripe/No. Females * 100) |                               |        |                          |        |                  |        |                  |        |
|---------------------------------------------------------|-------------------------------|--------|--------------------------|--------|------------------|--------|------------------|--------|
|                                                         | Colorado River<br>(main stem) |        | Little Colorado<br>River |        | Havasu Creek     |        | Shinumo Creek    |        |
|                                                         | Total<br>Females              | % Ripe | Total<br>Females         | % Ripe | Total<br>Females | % Ripe | Total<br>Females | % Ripe |
| Spring<br>2013                                          | -                             | -      | 37                       | 38     | 30               | 7      | -                | -      |
| Spring<br>2014                                          | -                             | -      | 23                       | 78     | 52               | 8      | -                | -      |
| Spring<br>2014                                          | -                             | -      | 28                       | 25     | -                | -      | -                | -      |
| Summer<br>2013                                          | 46                            | 63     | 37                       | 5      | -                | -      | 11               | 9      |
| Summer<br>2014                                          | 48                            | 31     | -                        | -      | -                | -      | 23               | 0      |
| Fall 2013                                               | 42                            | 31     | -                        | -      | -                | -      | -                | -      |
| Fall 2014                                               | 96                            | 25     | 51                       | 24     | -                | -      | -                | -      |
| Fall 2015                                               | 63                            | 19     | -                        | -      | -                | -      | -                | -      |







## Number of Stage 2 Females

|                      | July/August<br>2013<br>(Total S2F = 7) | July/August<br>2014<br>(Total S2F = 15) | September<br>2013<br>(Total S2F = 10) | September<br>2014<br>(Total S2F = 51) | September<br>2015<br>(Total S2F = 35) |
|----------------------|----------------------------------------|-----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
|                      | # S2                                   | # S2                                    | # S2                                  | # S2                                  | # S2                                  |
| 30 Mile              | 2                                      | 6                                       | 0                                     | 11                                    | 4                                     |
| LCR + Lava Chuar     | 2                                      | 4                                       | 1                                     | 28                                    | 26                                    |
| Bright Angel         | 0                                      | 0                                       | 0                                     | 0                                     | 1                                     |
| Shinumo Creek        | 0                                      | 0                                       | 0                                     | 1                                     | 0                                     |
| Stephen's Isle       | 0                                      | 0                                       | 0                                     | 3                                     | 2                                     |
| Middle Granite Gorge | 0                                      | 0                                       | 5                                     | 4                                     | 0                                     |
| Havasus Creek        | 2                                      | 3                                       | 3                                     | 3                                     | 2                                     |
| Pumpkin Springs      | 0                                      | 0                                       | 1                                     | 1                                     | 0                                     |
| Deer Creek           | 0                                      | -                                       | -                                     | -                                     | -                                     |
| Kanab Creek          | 1                                      | -                                       | -                                     | -                                     | -                                     |
| Parashant            | 0                                      | 2                                       | 0                                     | 0                                     | 0                                     |



## Number of Stage 3 (Potentially Ripe) Females

|                      | July/August<br>2013<br>(Total S3F = 30) | July/August<br>2014<br>(Total S3F = 15) | September<br>2013<br>(Total S3F = 13) | September<br>2014<br>(Total S3F = 24) | September<br>2015<br>(Total S3F = 12) |
|----------------------|-----------------------------------------|-----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
|                      | # S3                                    | # S3                                    | # S3                                  | # S3                                  | # S3                                  |
| 30 Mile              | 8                                       | 10                                      | 0                                     | 8                                     | 2                                     |
| LCR + Lava Chuar     | 2                                       | 2                                       | 0                                     | 12                                    | 7                                     |
| Bright Angel         | 5                                       | 0                                       | 0                                     | 1                                     | 0                                     |
| Shinumo Creek        | 0                                       | 0                                       | 3                                     | 0                                     | 0                                     |
| Stephen's Isle       | 0                                       | 2                                       | 0                                     | 0                                     | 1                                     |
| Middle Granite Gorge | 0                                       | 1                                       | 8                                     | 2                                     | 1                                     |
| Havasus Creek        | 5                                       | 0                                       | 2                                     | 1                                     | 1                                     |
| Pumpkin Springs      | 0                                       | 0                                       | 0                                     | 0                                     | 0                                     |
| Deer Creek           | 4                                       | -                                       | -                                     | -                                     | -                                     |
| Kanab Creek          | 6                                       | -                                       | -                                     | -                                     | -                                     |



# Conclusions to Date

- Ultrasonic imaging can be used to:
  - Identify eggs
  - Evaluate egg maturity of female humpback chub
- Egg development in female humpback chub varies by:
  - Location
  - Time of year





# Conclusions to Date cont.

- Female fish with eggs within brightness range 32-44 were considered potentially ripe (Stage 3)
- Female fish with eggs detected at all sample locations and sample dates
  - Ripe females detected at all except Shinumo Creek 2014
- July/August 2013 sample
  - 63% of females with eggs were ripe
  - Ripe females detected at Deer Creek and Kanab





# Conclusions to Date cont.

- Colorado River (main stem) samples
  - Most ripe females in both summer samples from 30 Mile Aggregation
  - Most ripe females in September 2013 sample from Middle Granite Gorge aggregation
  - Most ripe females in September 2014 and 2015 from LCR Aggregation
  - No potentially ripe fish caught at Pumpkin Springs (don't catch adults)





# Acknowledgements

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# Questions?



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