How to scan ALL the fishes

Adam P. Summers, UW - Friday Harbor Labs
@Fishguy_FHL
What is CT scanning?
Serrasalmus medinai
• $100-$1,500 per scan

Serrasalmus medinai
• $100-$1,500 per scan
• 30 minutes - 12 hours

Serrasalmus medinai
Cyprinella lepida
• ~33,000 species

Cyprinella lepida
- ~33,000 species
- ~45 years
• ~33,000 species
• ~45 years
• ~$3-300 million
- ~33,000 species
- ~45 years
- ~$3-300 million
- scan fewer species
- ~33,000 species
- ~45 years
- ~$3-300 million
- scan fewer species
- scan faster
Karel F. Liem
BioImaging Center
Two obvious truths
Two obvious truths

- Cylindrical interrogation volume
Two obvious truths

- Cylindrical interrogation volume
- Don't want ALL the resolution
How much resolution?

Cochlioseps spatula
How much resolution?

- Depends on purpose

Cochlioseps spatula
How much resolution?

- Depends on purpose
- >250 slices across skull

*Cochlioseps spatula*
Cylinders and resolution

50 µm
20 slices/mm

30 µm
33 slices/mm
Resolution depends on fish size
Resolution depends on fish size

Pack the cylinder
Resolution depends on fish size

Pack the cylinder

10-20 specimens/scan
The fish burrito
Hypsagonus quadricornis
• #ScanAllFish

Hypsagonus quadricornis
- #ScanAllFish
- 1991 species

Hypsagonus quadricornis
- #ScanAllFish
- 1991 Species
- 3094 Specimens

Hypsagonus quadricornis
- #ScanAllFish
- 1991 species
- 3094 specimens
- 109 collections

Hypsagonus quadricornis
Strategy

- Attract stakeholders

Pallasina barbata
Strategy

- Attract stakeholders
- Viral training
Strategy

- Attract stakeholders
- Viral training
- Funding for bottlenecks
Strategy

- Attract stakeholders
- Viral training
- Funding for bottlenecks
- Funding for access
- Kory Evan-Jackson (LSU)

- Gymnotiform fishes

- 8 days in Nov 2016

- 77 species

- 238 specimens

- 1 paper submitted

- Sternarchorhynchus hagedornae
• Kory Evan-Jackson (LSU)
• Gymnotiform fishes
• 8 days in Nov 2016
• 77 species
• 238 specimens
• 1 paper submitted

Sternarchorhynchus hagedornae
• Chris Anderson
• Chris Anderson
• Chameleons
• 6 days in Apr 2017
• 97 species
• 138 specimens
• Loan refused
Unfunded Scanning Rate

4/16 6/16 8/16 10/16 12/16 2/17 4/17 6/17
Unfunded Scanning Rate

211 specimens a month
Space - the terrifying frontier
Space - the terrifying frontier

- 29 TB for 3096 specimens
Space - the terrifying frontier

• 29 TB for 3096 specimens

• 9.3 GB per specimen
Space - the terrifying frontier

- 29 TB for 3096 specimens
- 9.3 GB per specimen
- 2 TB per month
Space - the terrifying frontier

• 29 TB for 3096 specimens
• 9.3 GB per specimen
• 2 TB per month
• 300 TB for all fishes
Space - the terrifying frontier

• 29 TB for 3096 specimens
• 9.3 GB per specimen
• 2 TB per month
• 300 TB for all fishes

What should we save?
Open Access - Copyrights

Access leads to innovation
Open Access - Copyrights

- All data are available #OA

Access leads to innovation
Open Access - Copyrights

- All data are available #OA
- Data are available CC-BY

Access leads to innovation
Open Access - Copyrights

• All data are available #OA
• Data are available CC-BY
• Open Science Framework

Access leads to innovation
Open Access - Copyrights

• All data are available #OA
• Data are available CC-BY
• Open Science Framework
• MorphoSource

Access leads to innovation
Adam Summers from the Friday Harbor Labs at the University of Washington has made it possible that a large number of CT scans of primarily fishes is available for the scientific community. The dissemination of such material is difficult for two reasons. First, producers often reserve copyrights to their material. Second, datasets are frequently in the range of GigaBytes and to view these data requires download times of hours and special programs and conversion before such datasets can be inspected.

Often however, downsampled versions are sufficient and they allow direct inspection in a browser.

- Michael Hoffman
- Automated surface renders
- Rotatable + printable
oVert - 'all the vertebrates
• Overt - 'all' the vertebrates

• Dave Blackburn at UF
• oVert - ‘all’ the vertebrates
• Dave Blackburn at UF
• 15 collections
Stephanie Crofts  Joe Bizzarro  Petra Ditsche  Bob Rubin  Ashley Peterson
Misty Paig-Tran  Cheryl Wilga  Thomas Kleinteich  Marianne Porter
Thaddaeus Buser  Cassandra Donatelli  Diego Vaz  Alice Gibb  Kory Evans-Jackson

National Science Foundation
WHERE DISCOVERIES BEGIN
Thanks...

Ellie

Abel

Sharalyn