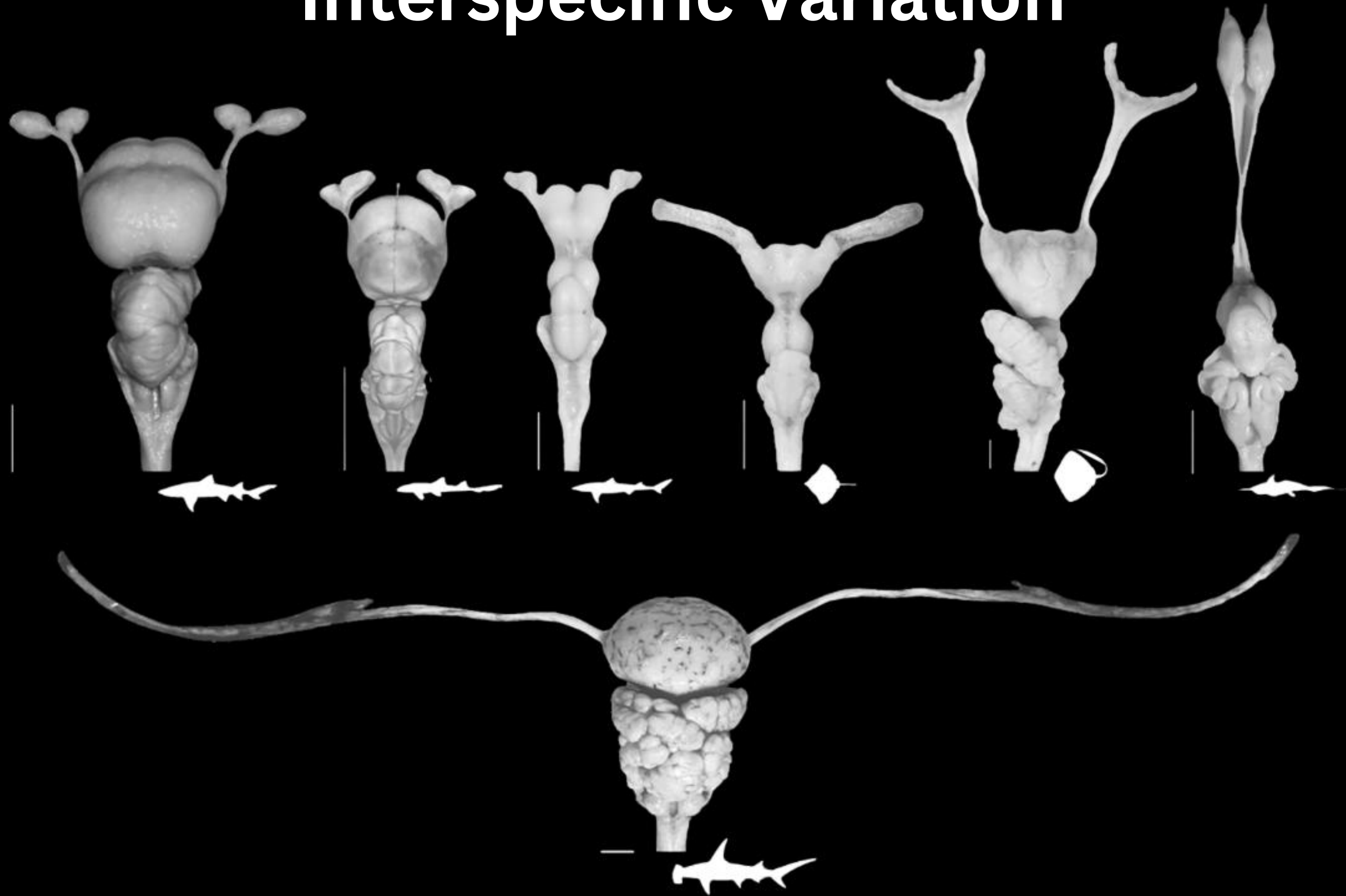


Using MRI to Assess Brain Growth & Morphology of the Smalltooth Sawfish, *Pristis pectinata*, for Comparison to Neurocompromised Individuals from the 2024 Spinning Event

Maria Pierce, Emily Peele, Gregg Poulakis, Andrew Wooley, Lukas Heath, Dylan Yakich, Tonya Wiley, Kara Yopak



Interspecific Variation

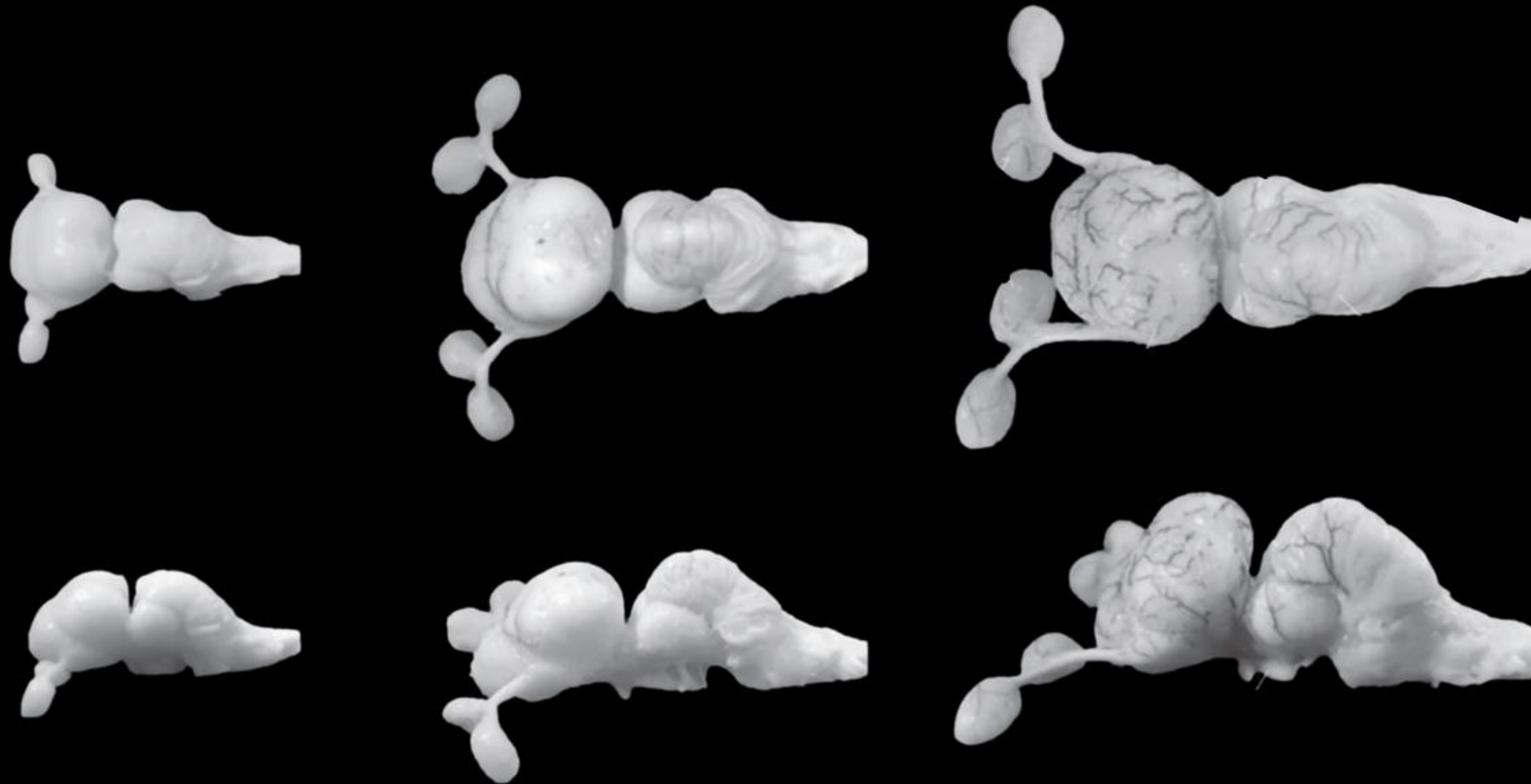


— 1 cm

Ontogenetic Shifts



Ontogenetic Shifts



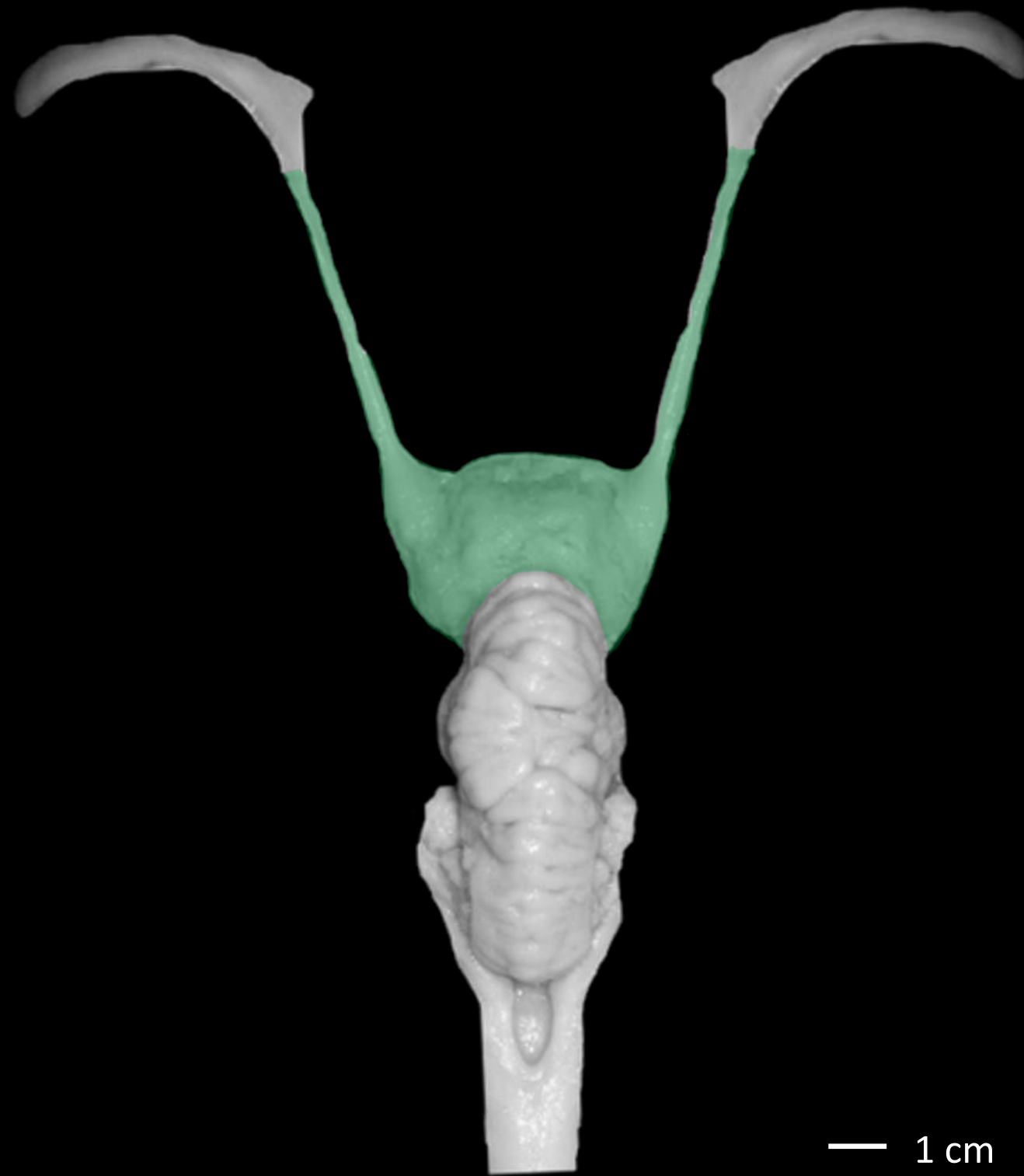
— 1 cm

YOY

Juvenile

Adult

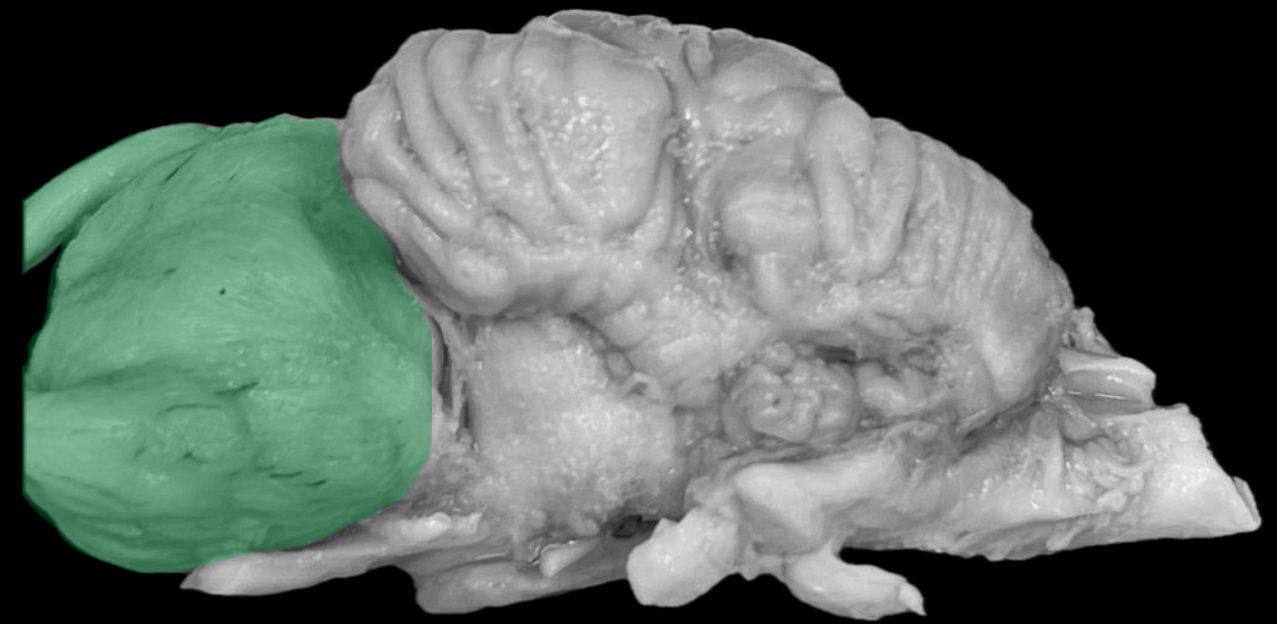
Brain and Major Regions



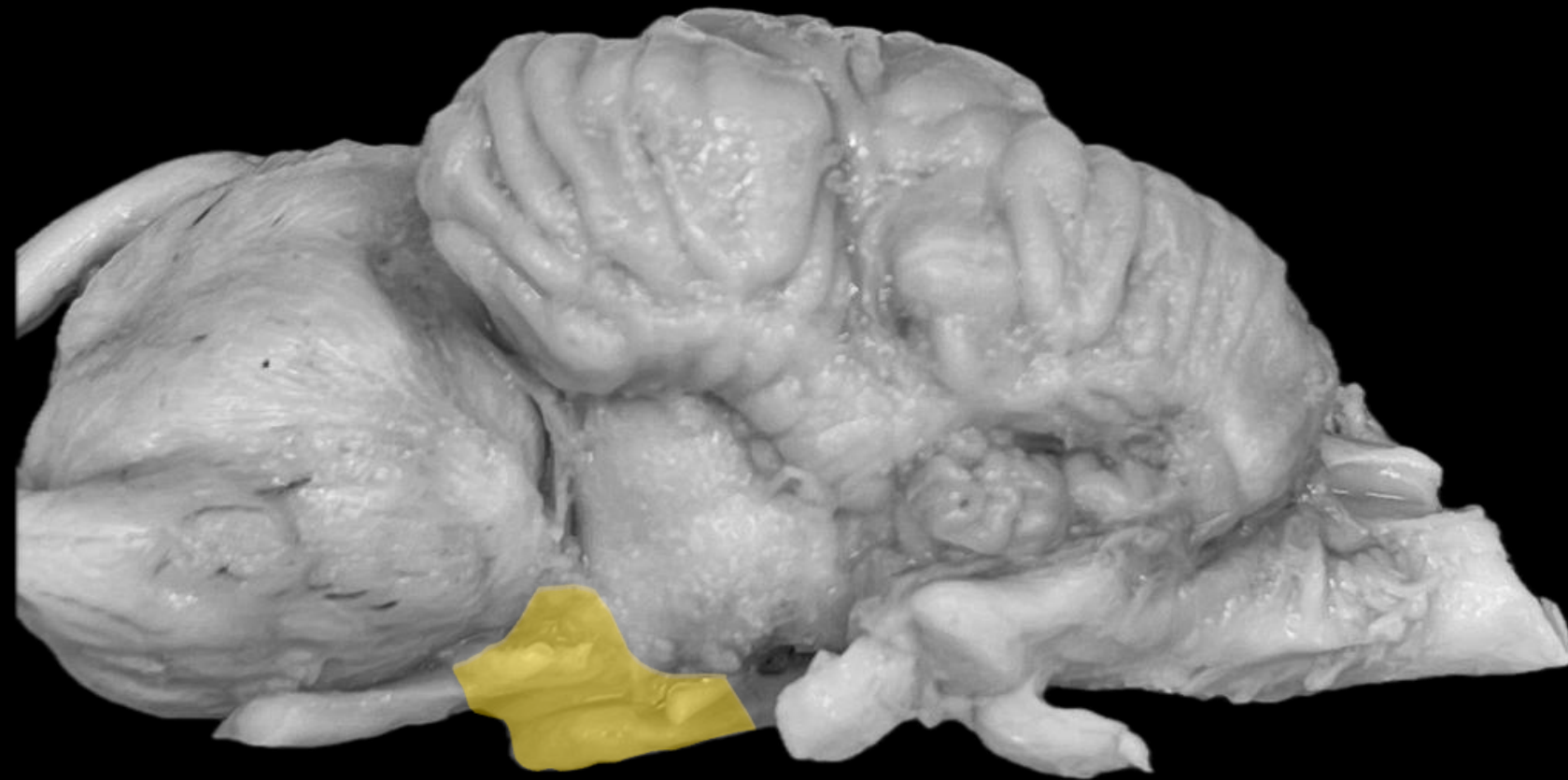
Telencephalon

Higher cognitive functions

- Spatial learning
- Memory



Brain and Major Regions



Diencephalon

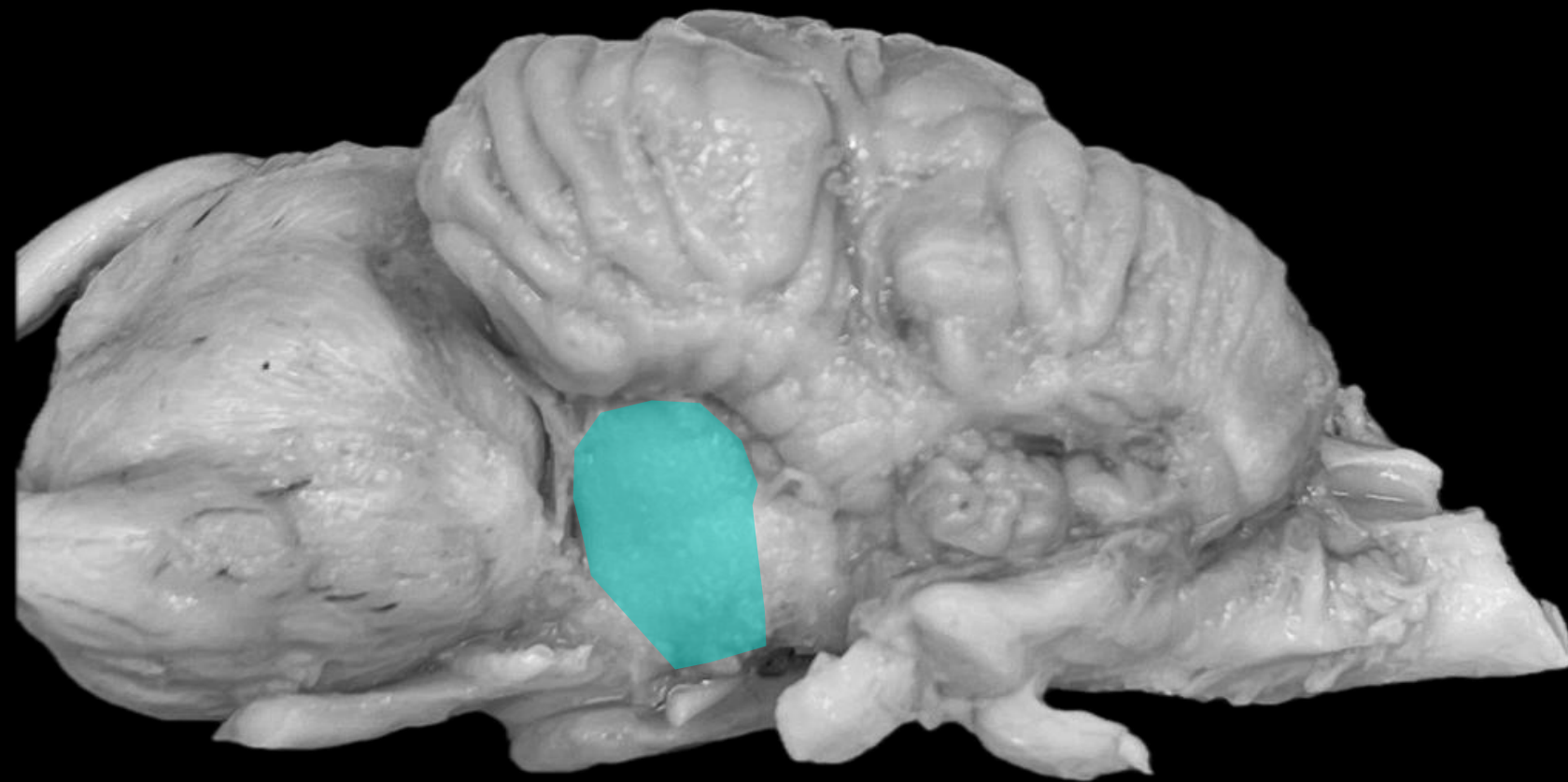
Interface between brain and
endocrine system

— 1 cm

Brain and Major Regions

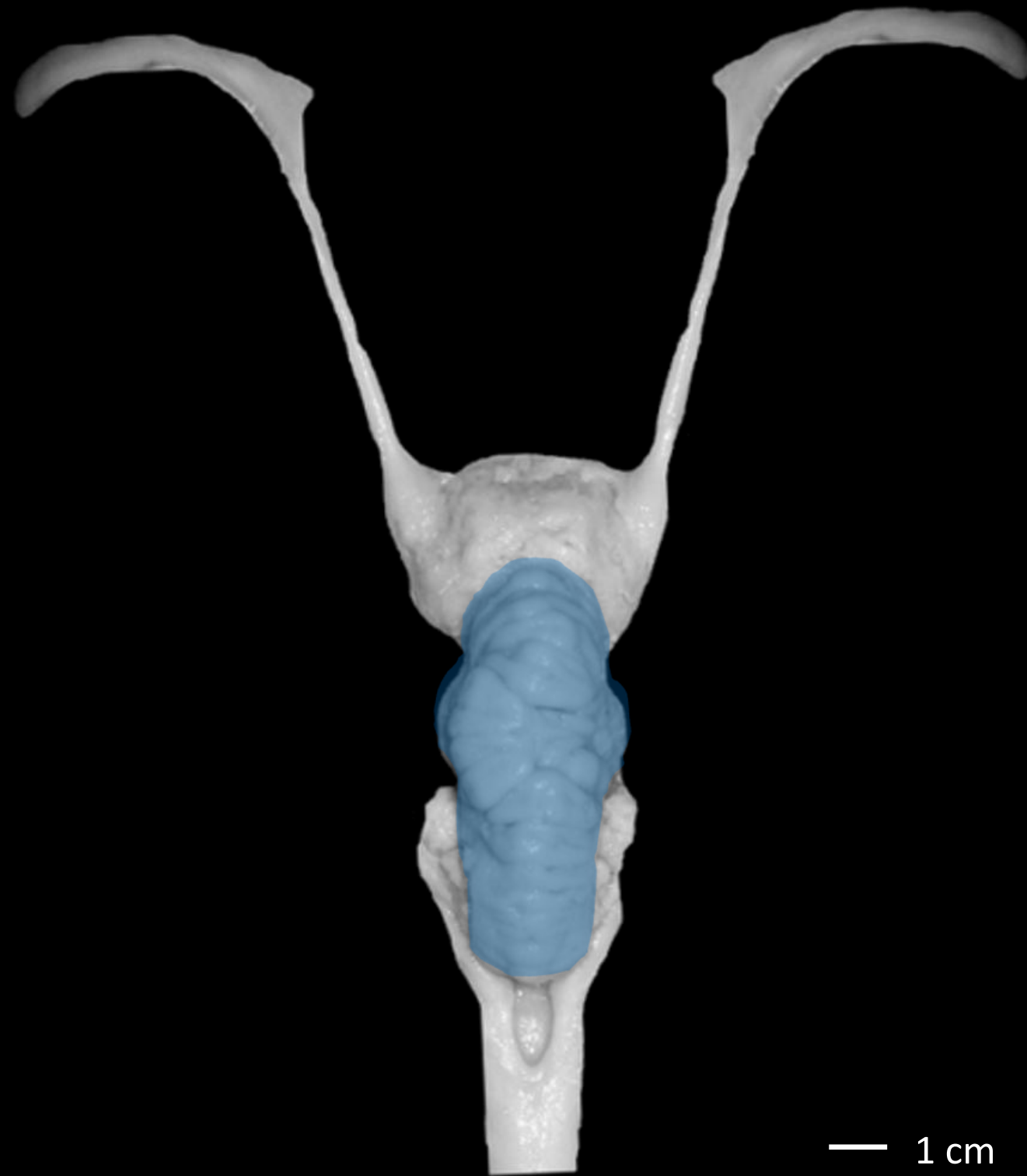
Mesencephalon

Vision and sensory integration



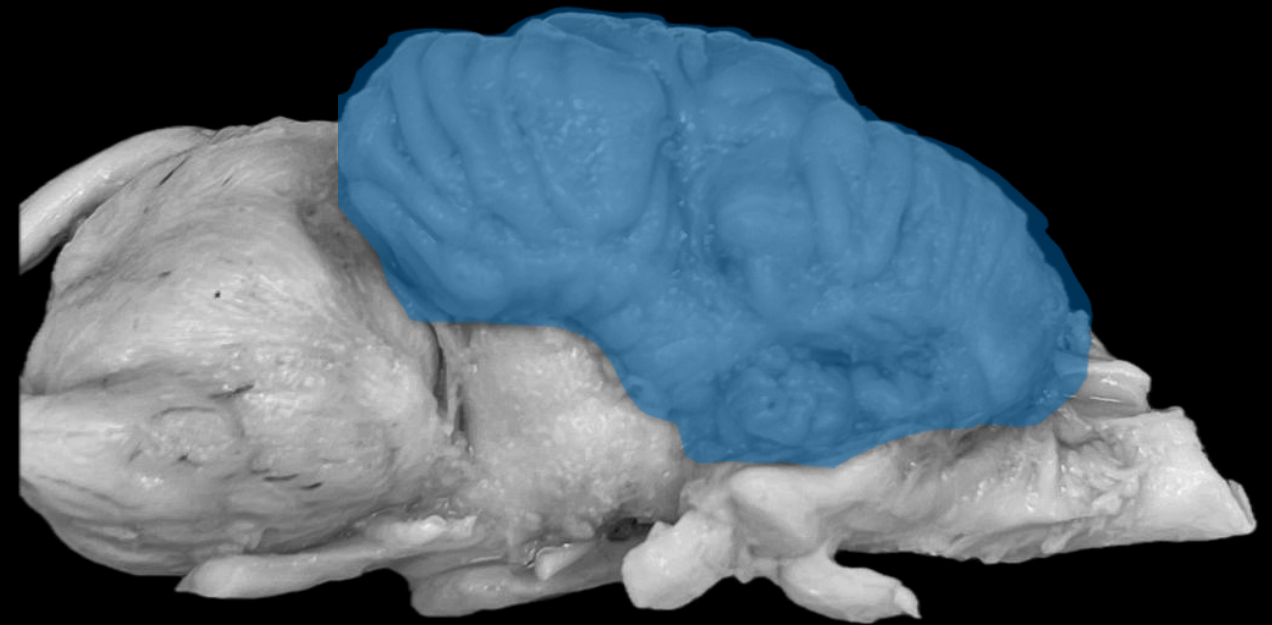
— 1 cm

Brain and Major Regions



Cerebellum

**Motor control and
target tracking**



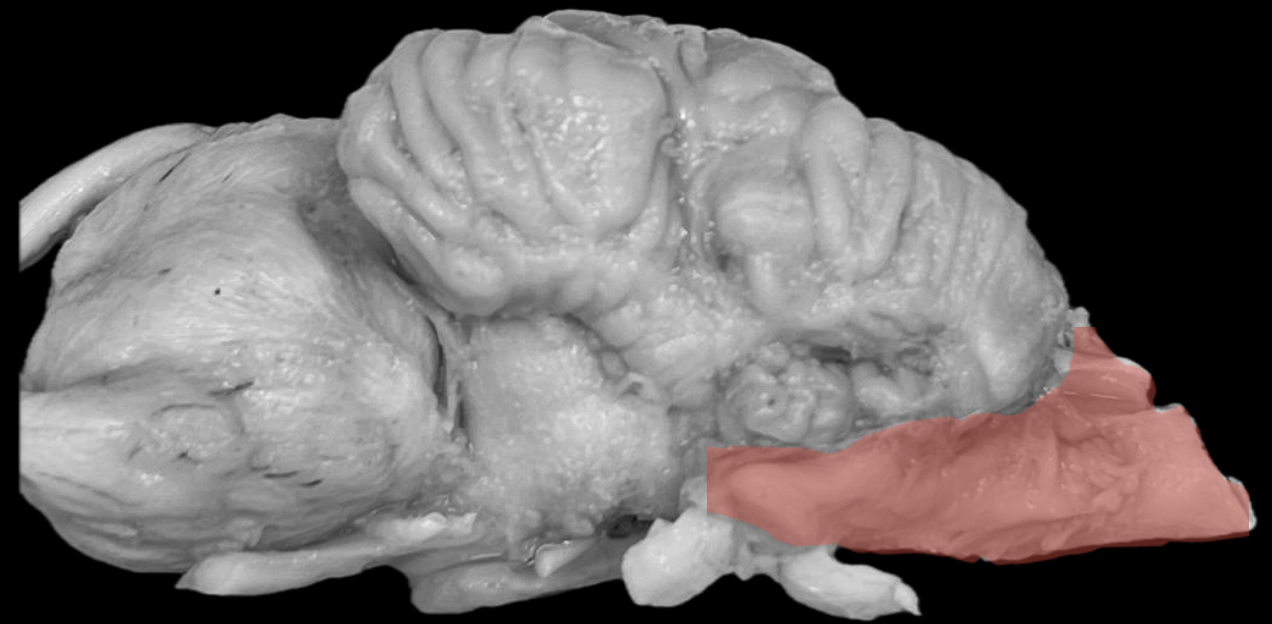
— 1 cm

Brain and Major Regions



Medulla

- Input from electroreceptors & lateral line
- Homeostatic functions



Less is known about rare & endangered species



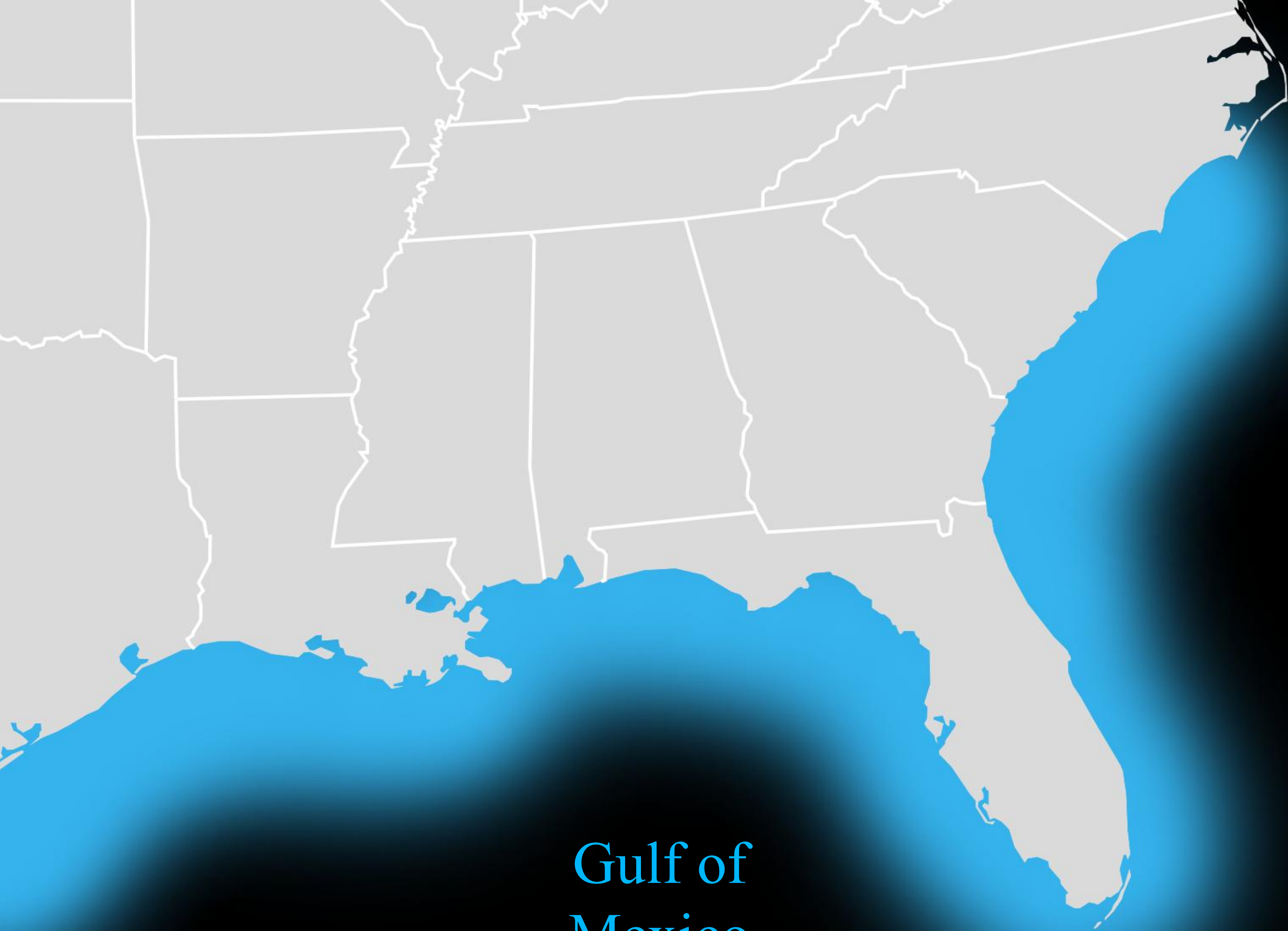
Smalltooth Sawfish, *Pristis pectinata*



Smalltooth Sawfish, *Pristis pectinata*



Habitat shift from juveniles to adults



Atlantic
Ocean

Gulf of
Mexico



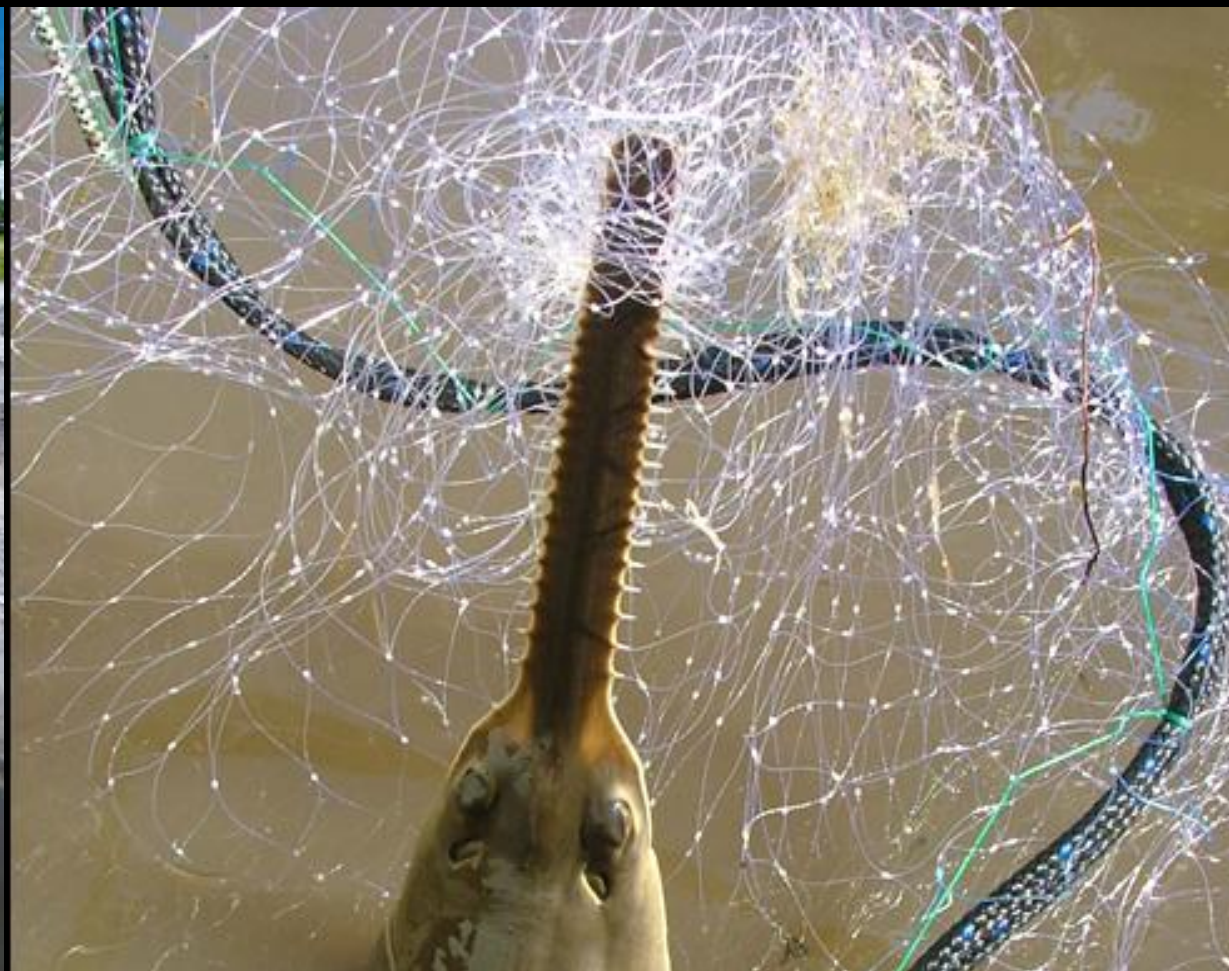
Atlantic
Ocean

Gulf of
Mexico

Smalltooth Sawfish, *Pristis pectinata*



Habitat degradation



Fisheries/Bycatch



Climate change

Florida 'Fish Spinning' Event



Objectives



Quantify brain organization across ontogeny



Compare with other elasmobranchs



Compare with neurocompromised individuals

Sample Collection

Non-spinners	Spinners
n = 17 YOY: 8 Juvenile: 7 Adult: 2	n = 11 YOY: 0 Juvenile: 6 Adult: 5



Magnetic Resonance Imaging (MRI)



Radiofrequency
(RF) Pulse



Proton
Excitation

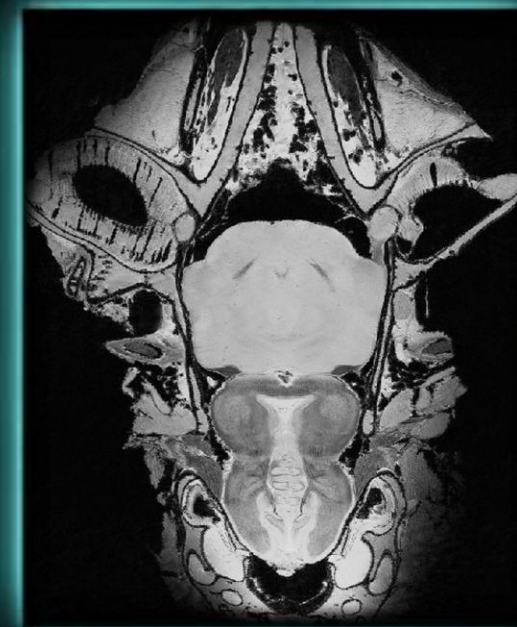


Signal Detection
& Digitization



...01001110...

Final High-Resolution
Image Output



Imaging



Specimen

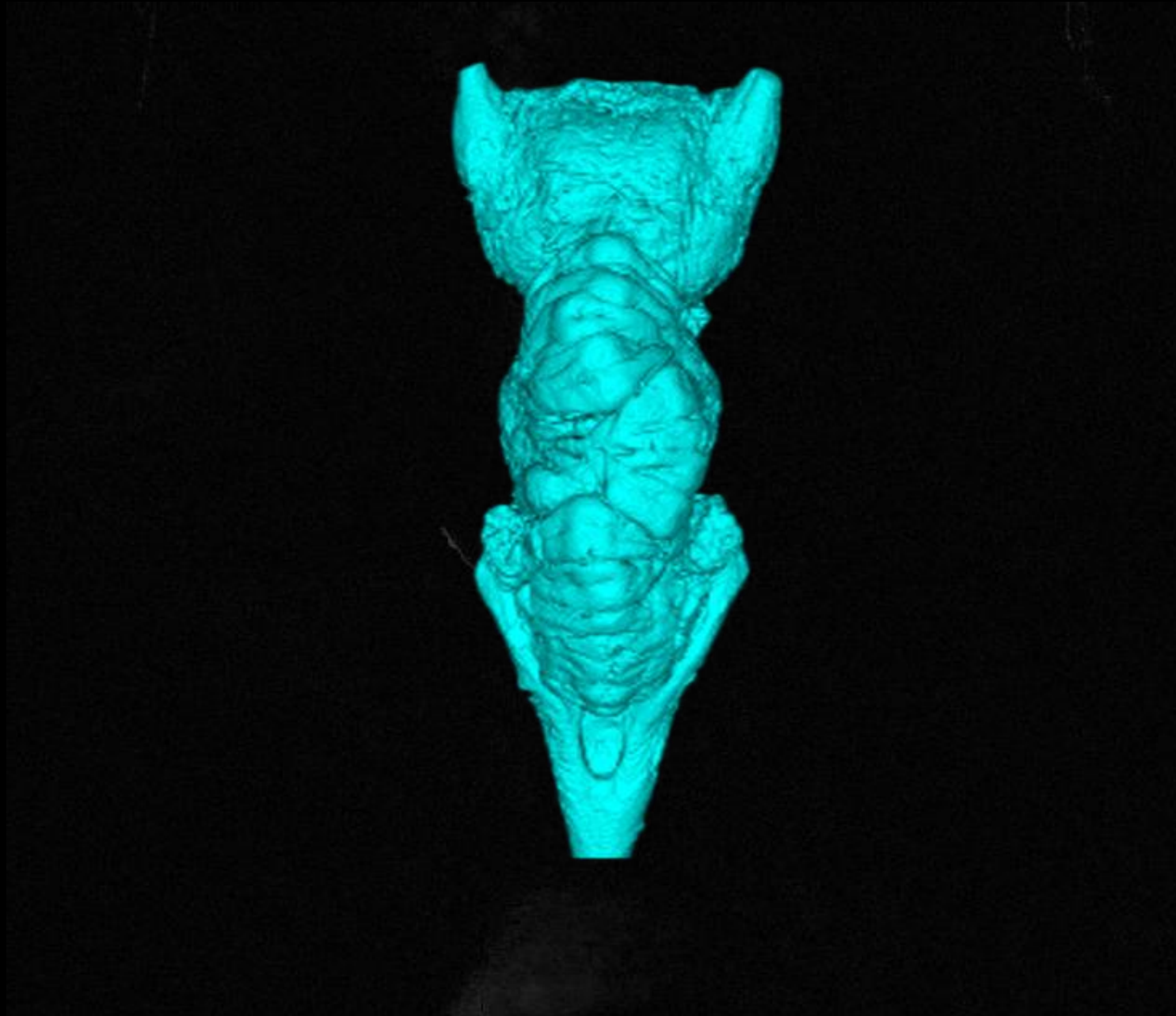


Imaging
Chamber



9.4T UNC
Chapel Hill

Imaging



3D Rendering

Resolution: 70 – 100 μ m
Scan time: ~ 6 - 34 hours

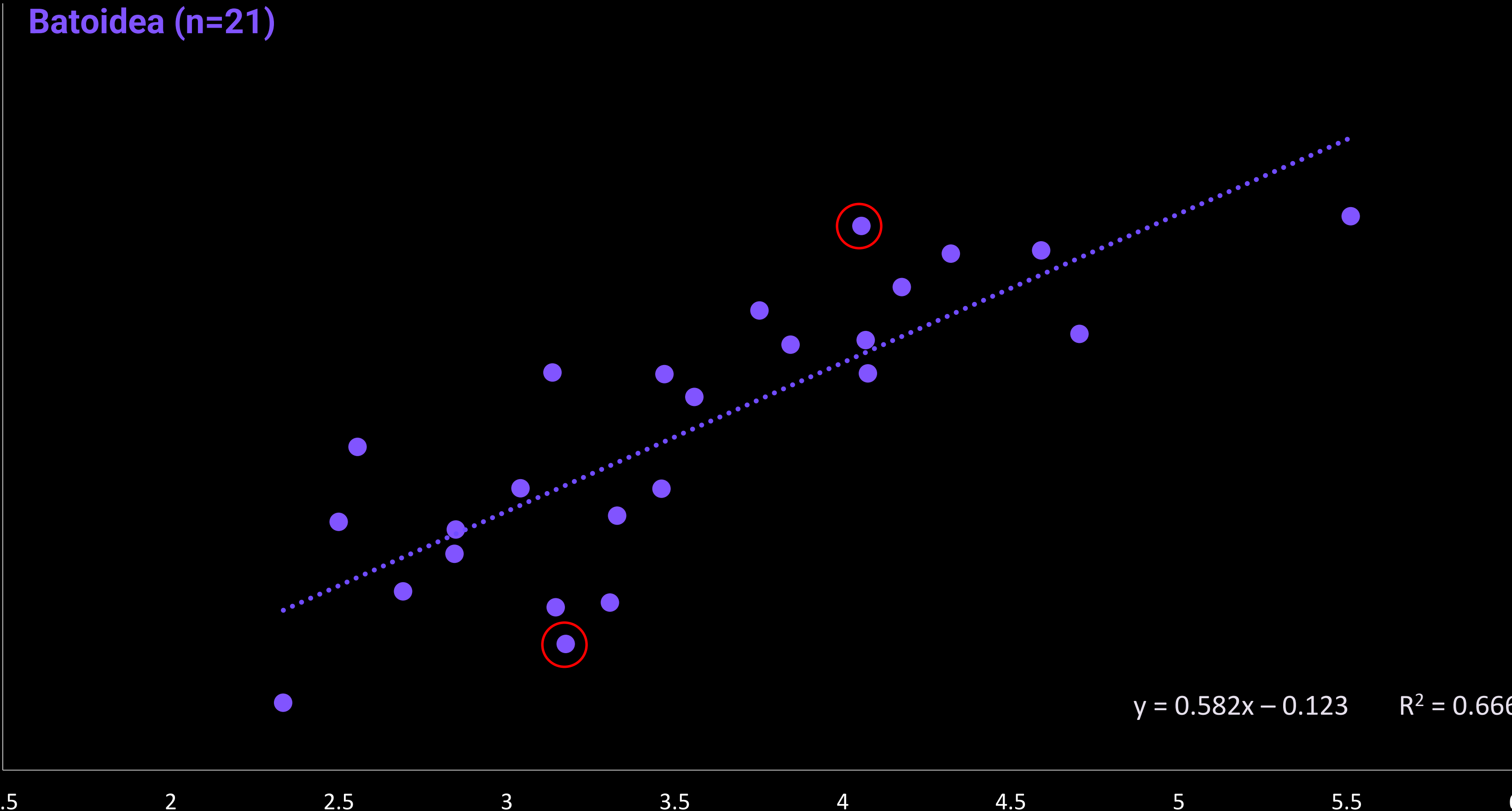
Batoidea Brain-Body Scaling

Batoidea (n=21)

log₁₀ brain mass (g)

log₁₀ body mass (g)

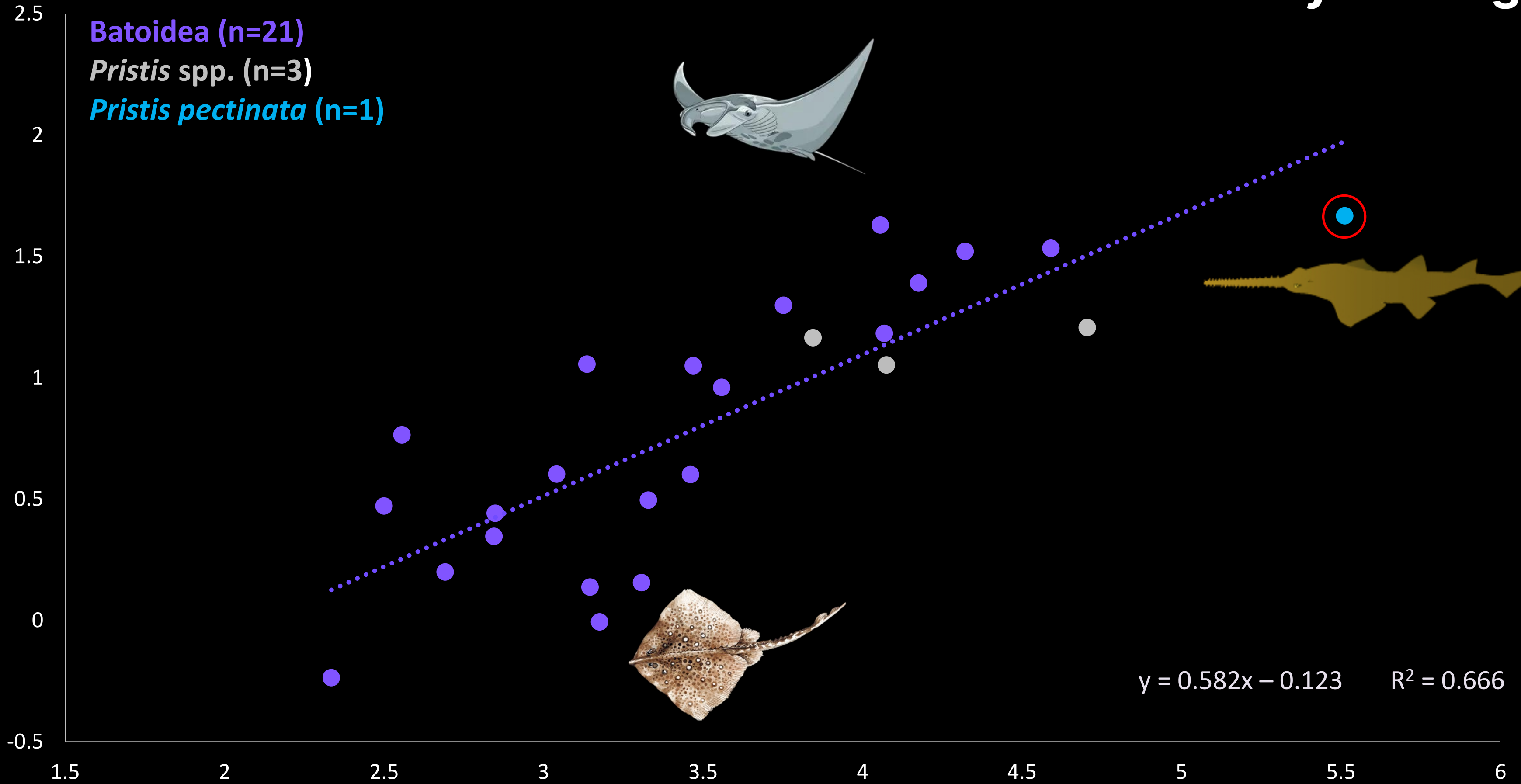
$y = 0.582x - 0.123$ $R^2 = 0.666$



Batoidea Brain-Body Scaling

Batoidea (n=21)
Pristis spp. (n=3)
Pristis pectinata (n=1)

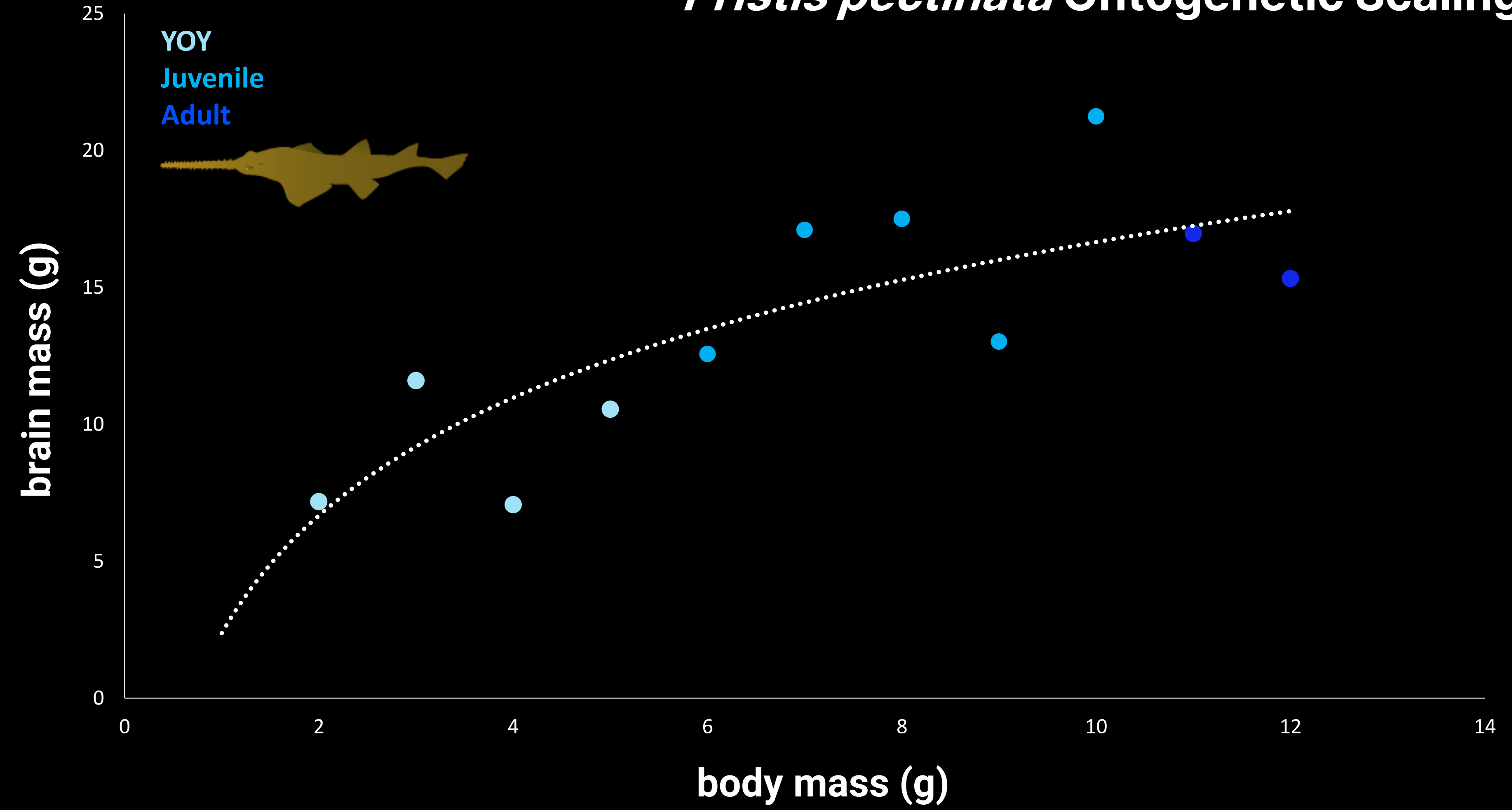
log₁₀ brain mass (g)



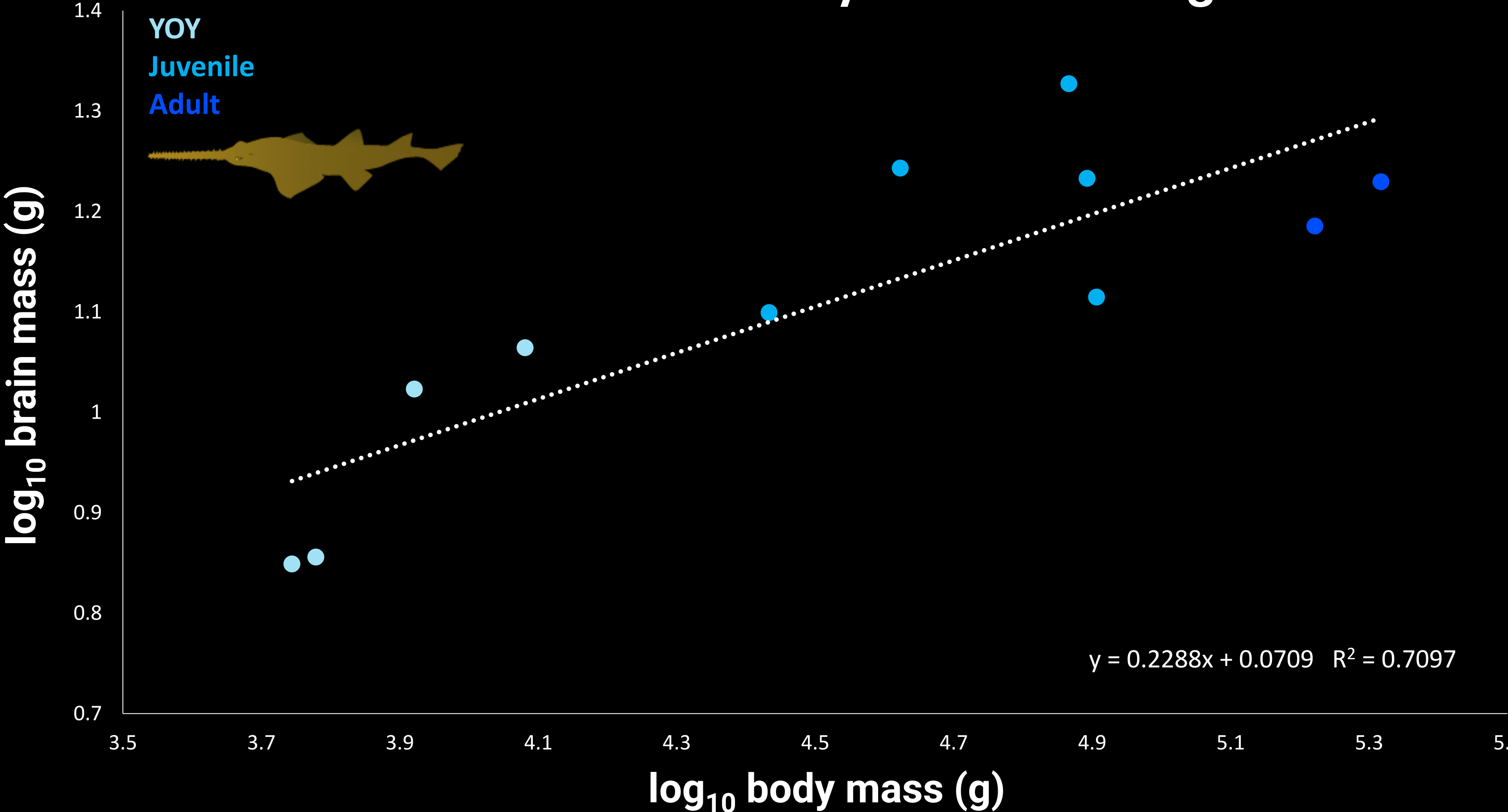
$y = 0.582x - 0.123$ $R^2 = 0.666$

log₁₀ body mass (g)

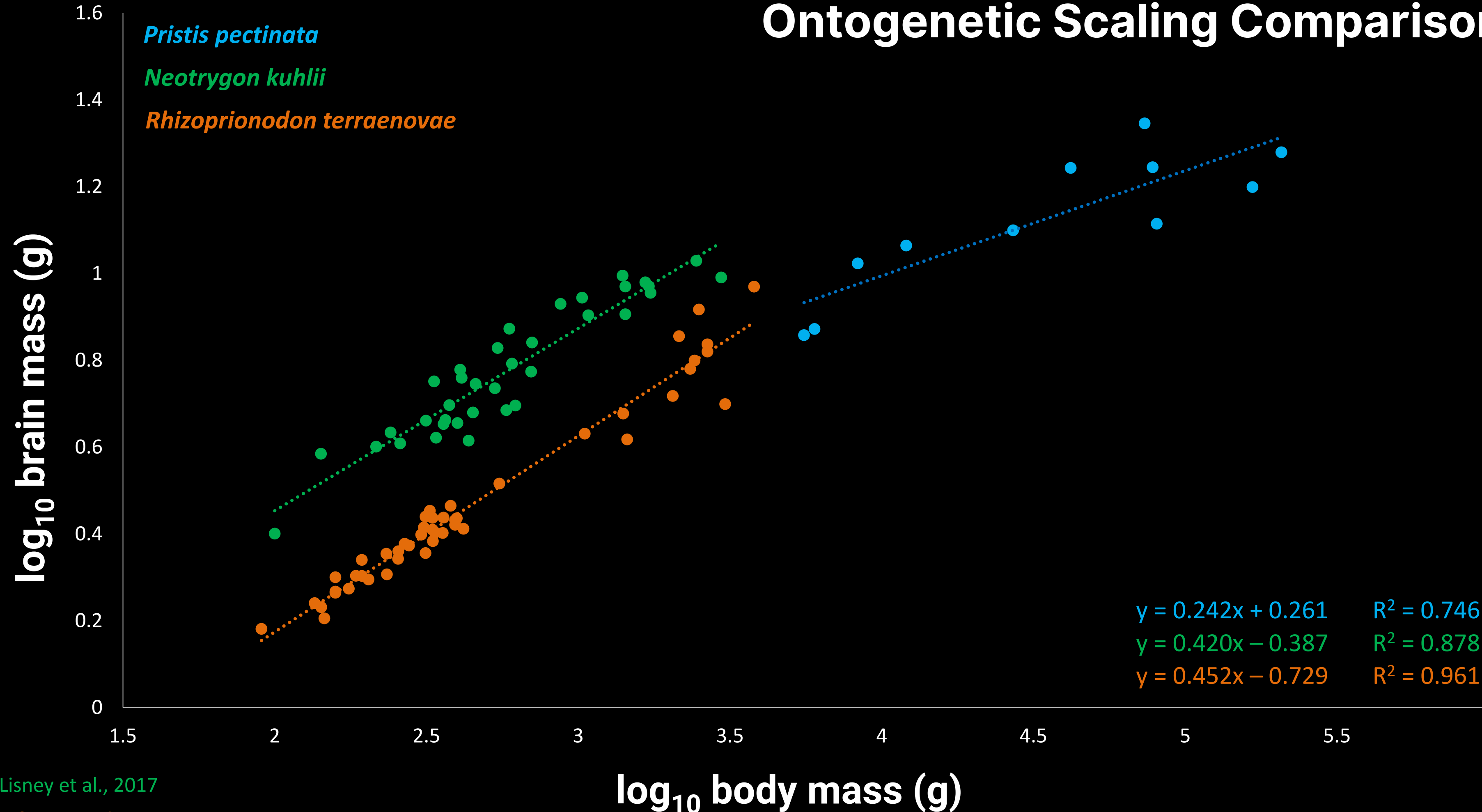
Pristis pectinata Ontogenetic Scaling



Pristis pectinata Ontogenetic Scaling

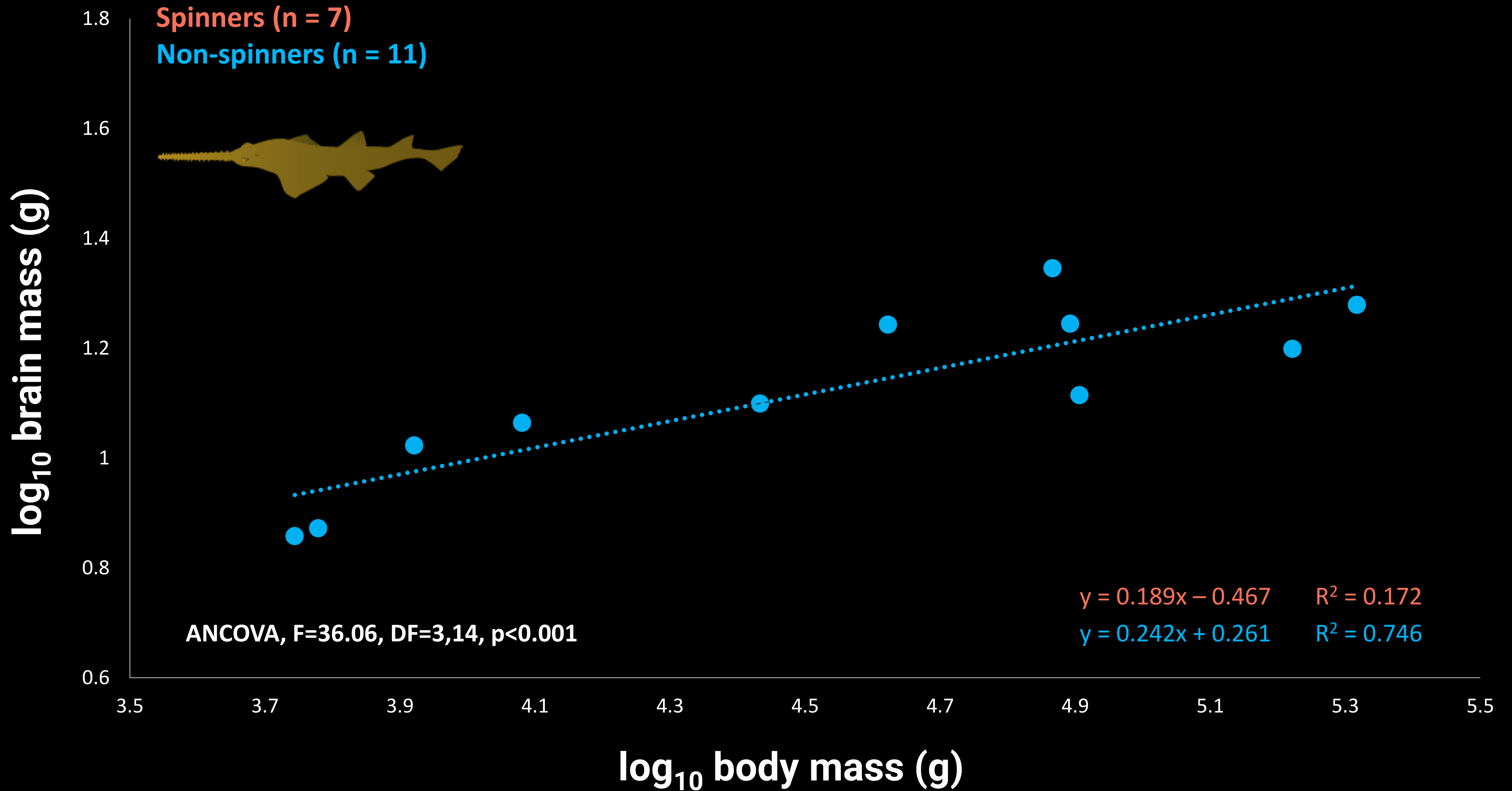


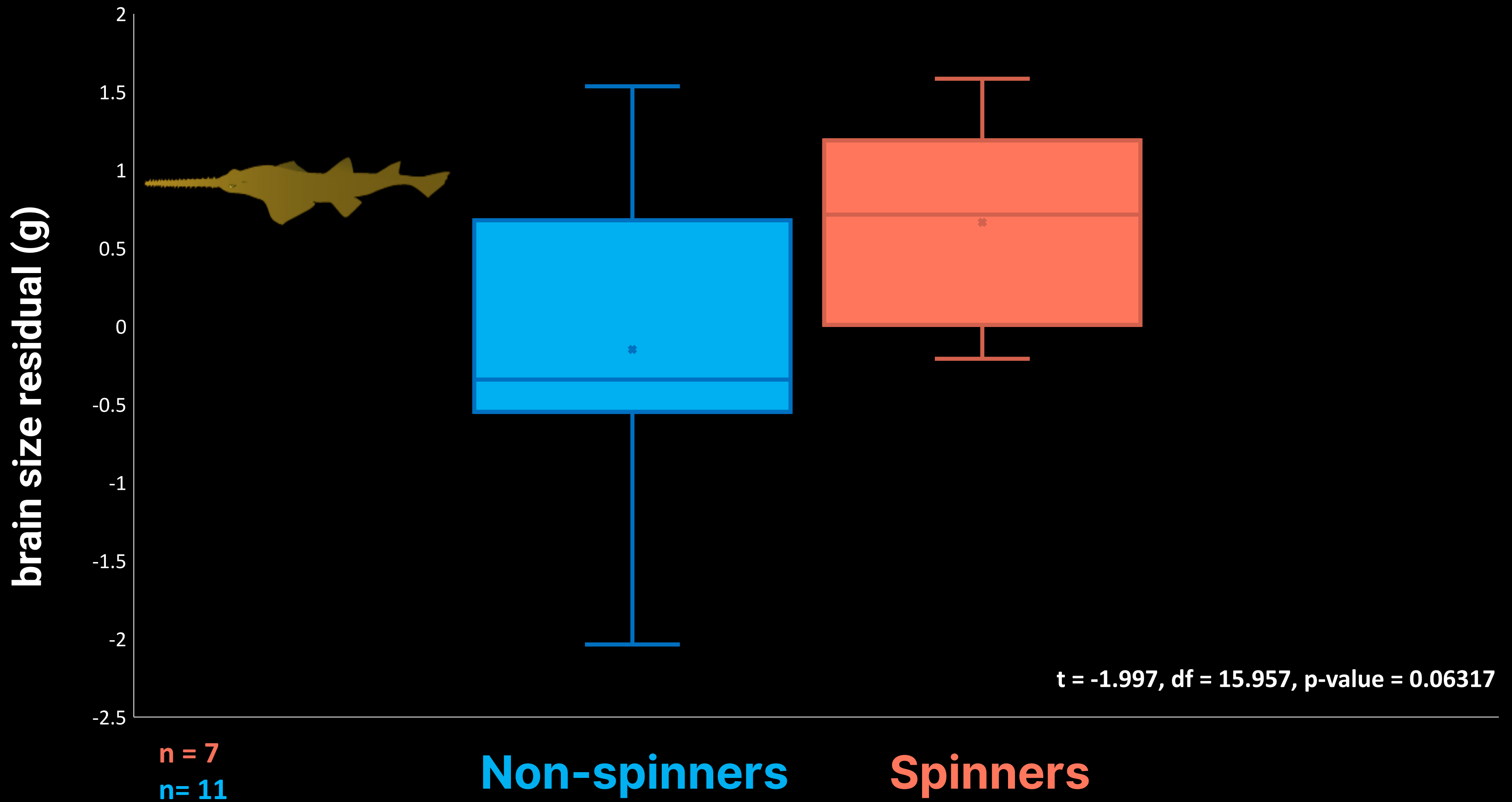
Ontogenetic Scaling Comparisons



Lisney et al., 2017

Laforest et al. 2020





Non-spinners

Spinners



Conclusions & Next Steps



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American Elasmobranch Society



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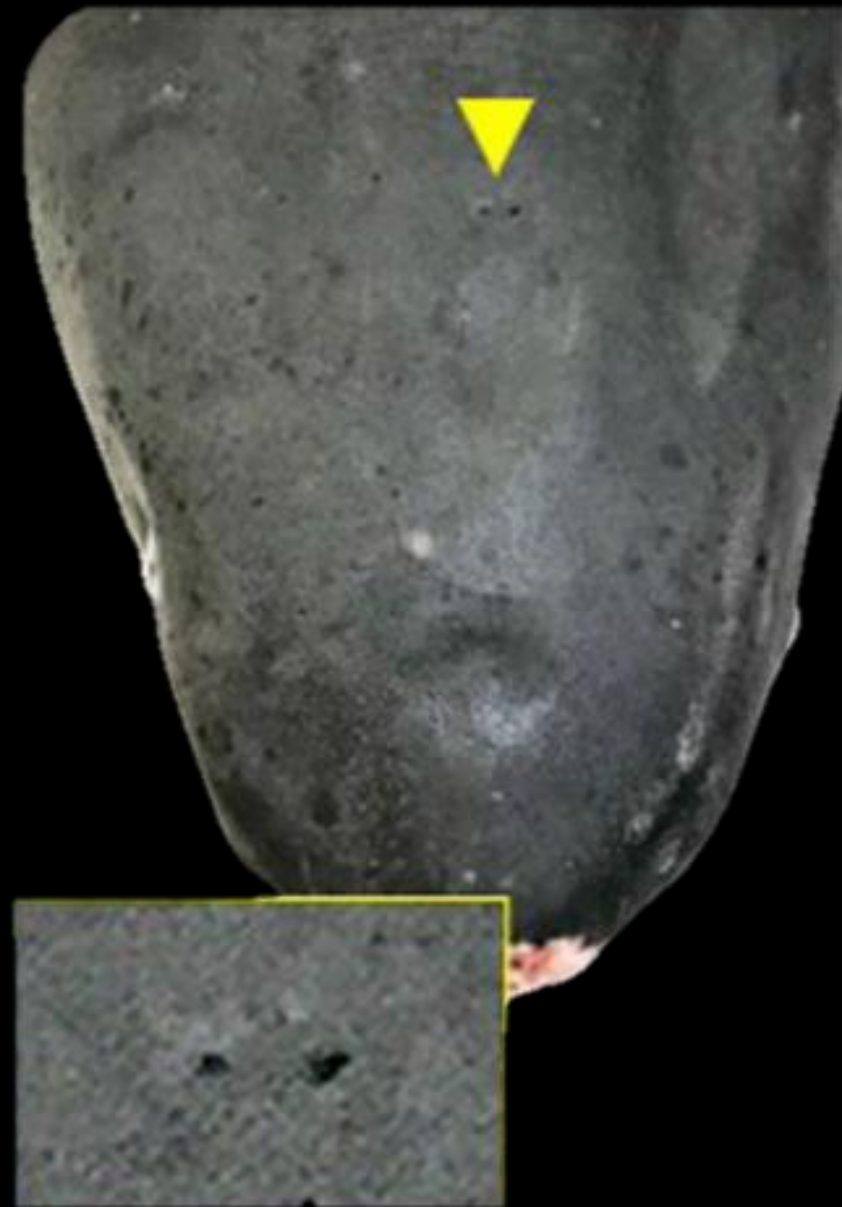
All activities performed under
authorization and guidance of
NOAA Fisheries Emergency
Section 7 Consultation
#SERO-2024-00402

and

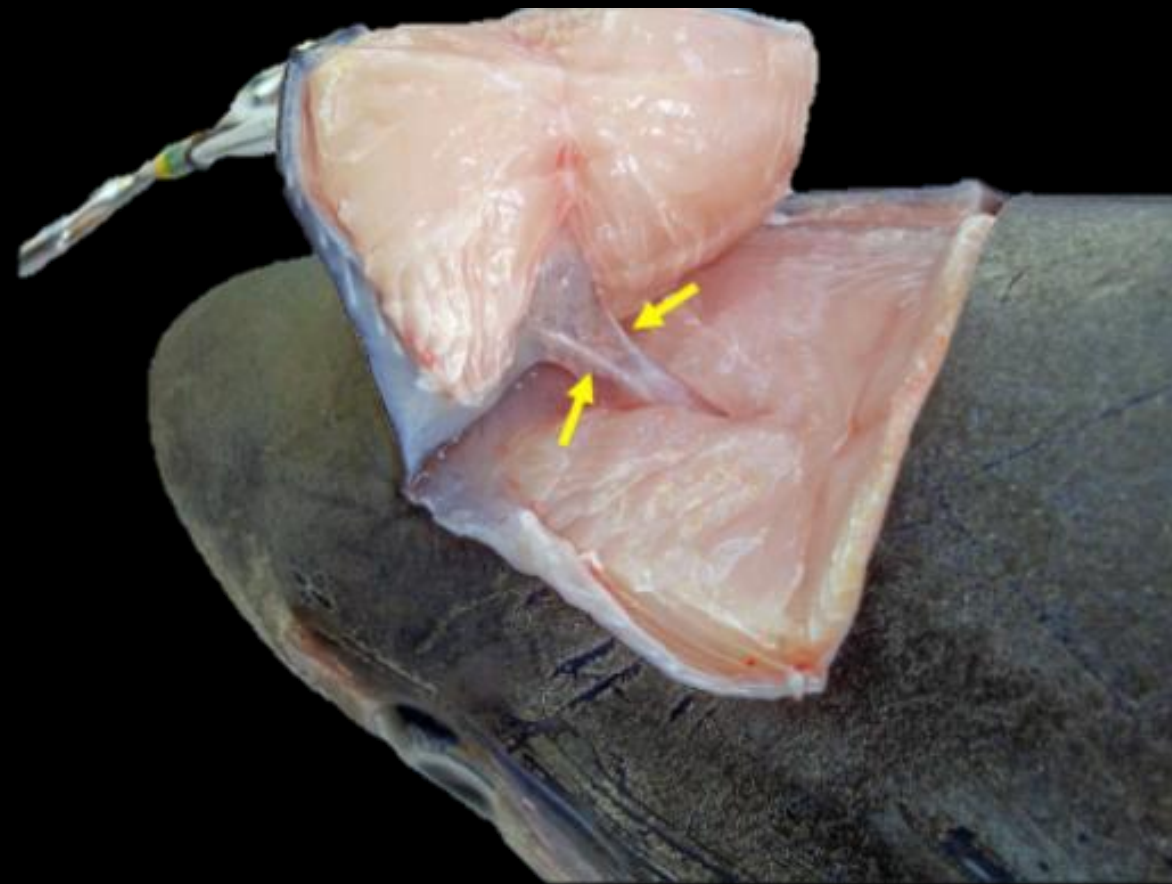
ESA Section 10 permits
to Gregg Poulakis,
Tonya Wiley, John Carlson, and
Colin Simpfendorfer



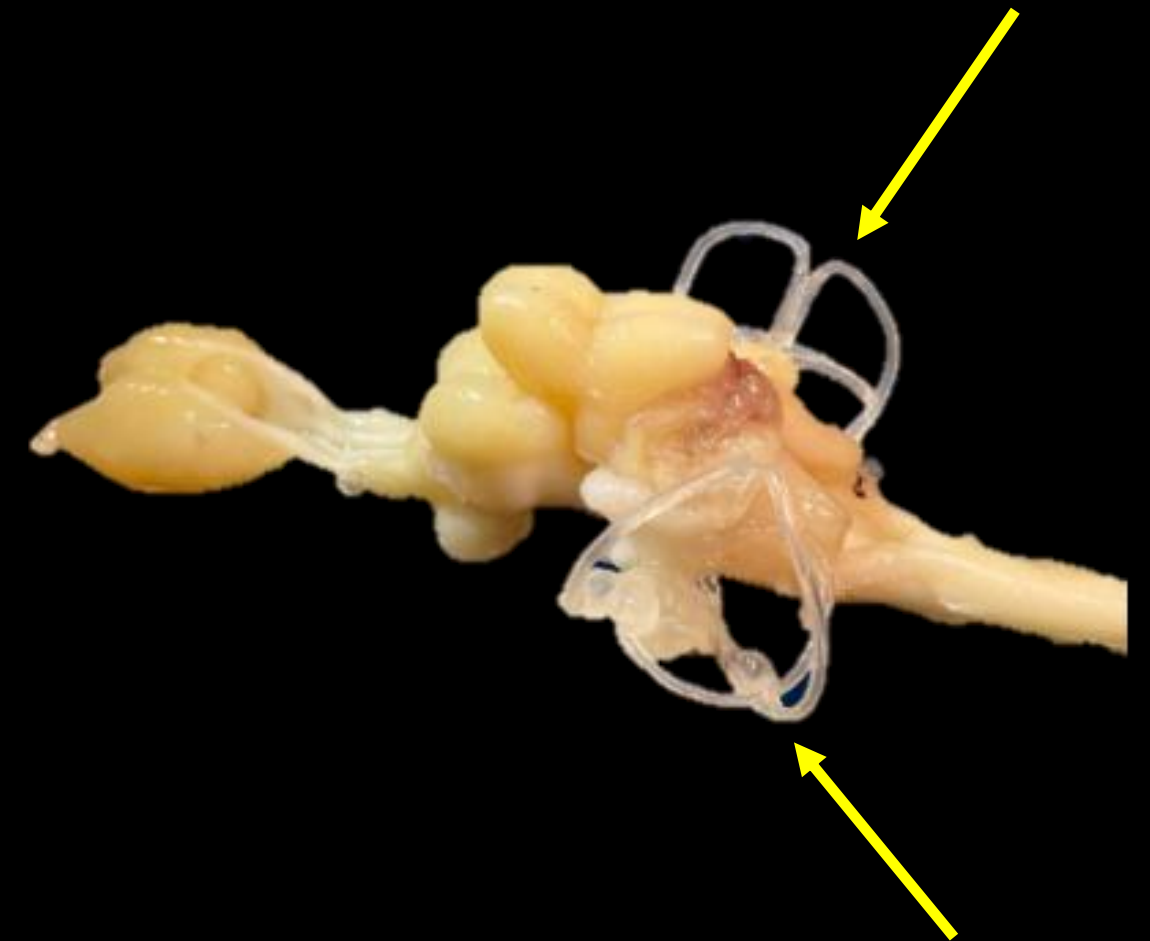
Inner Ear



**Endolymphatic
pores**



**Endolymphatic
ducts**



Brain & inner ear

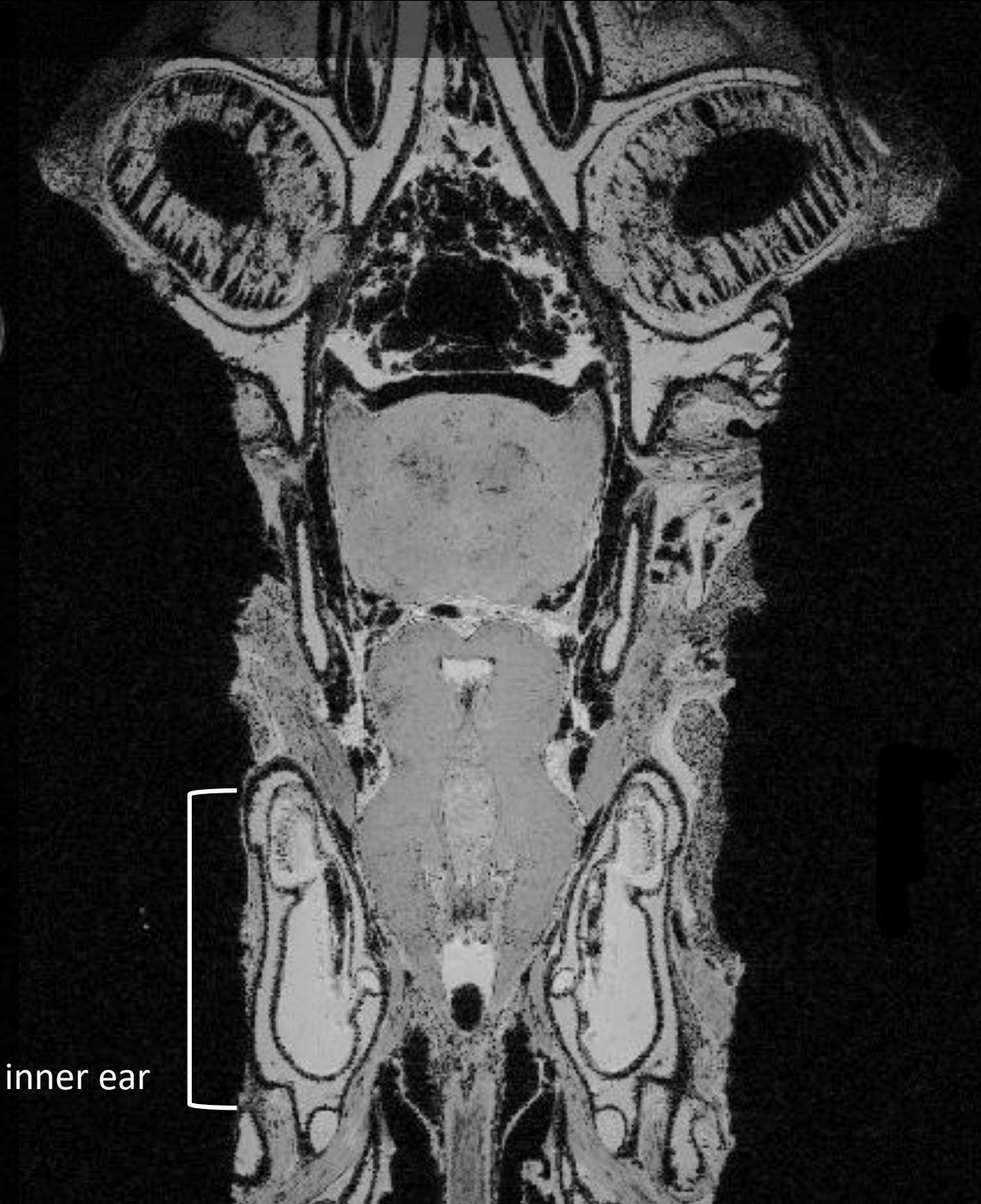
Preliminary Results



Pristis zijsron
Longcomb sawfish



Pristis microdon
Largetooth sawfish



Pristis clavata
Dwarf sawfish