The Value of Imaging Specimens in Ichthyology

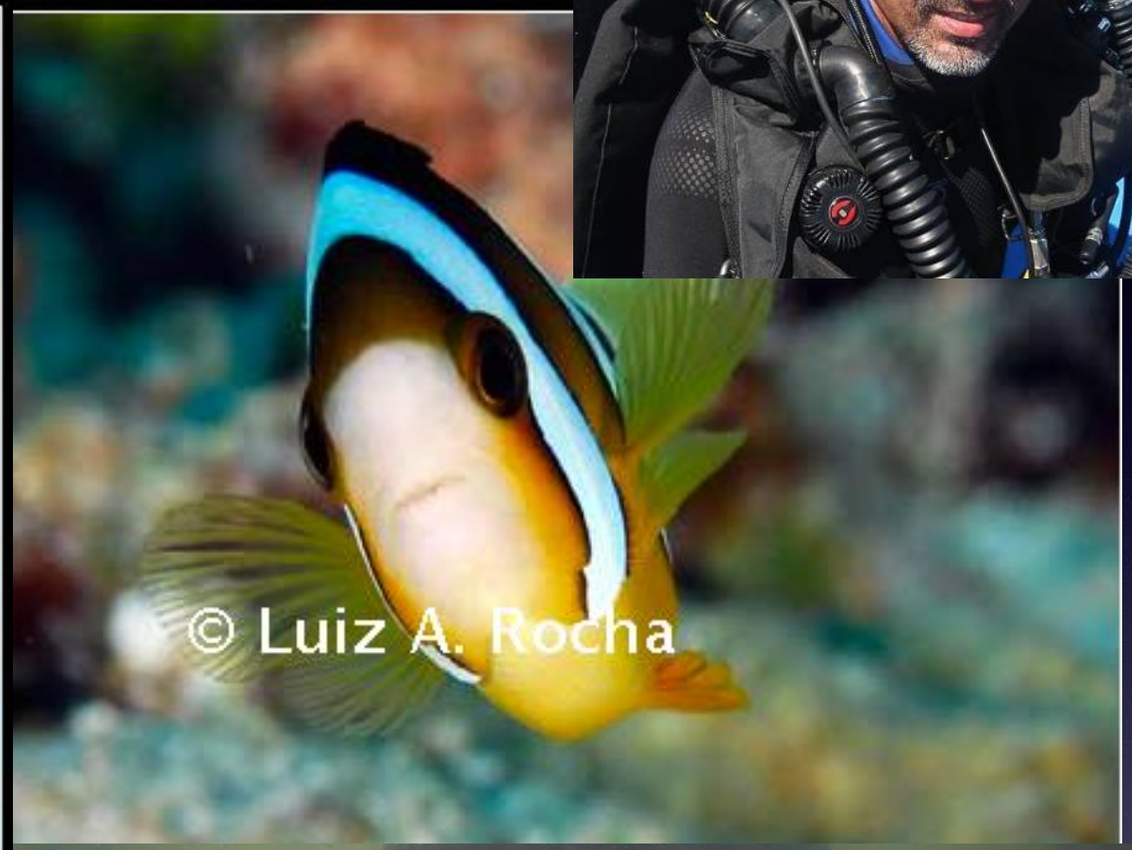
John P. Sullivan, Cornell University Museum of Vertebrates

iDigBio Vertebrate Digitization Workshop, Berkeley, CA, April 4-6, 2016

Brian Sidlauskas

Adam Summers

Not talking about: photos of living fishes



What I am talking about…

Visible light photographs of whole fish specimens (alive or dead) already accessioned or soon-to-be accessioned in a natural history collection.

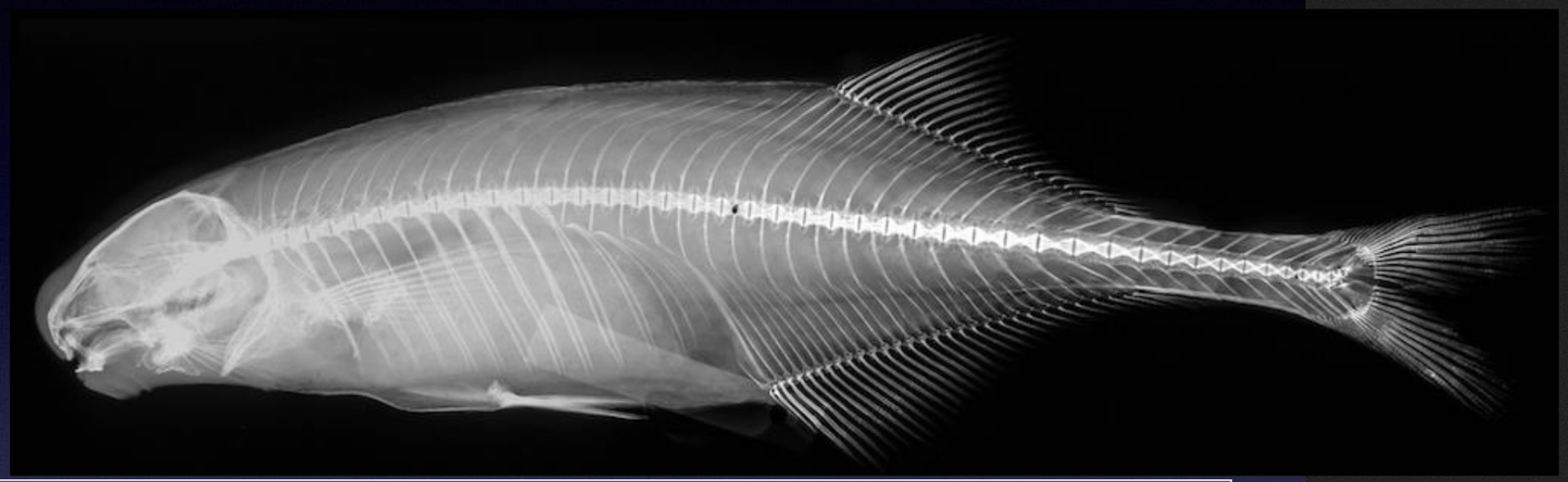
Pollimyrus sp. CUMV 97656, male (left), 63 mm SL, JPS-549, female (right) 60 mm SL, JPS-554; UNIKIS-10-83, 16-Sep-2010, Masindula Creek, Kisangani, Province Orientale, D.R. Congo

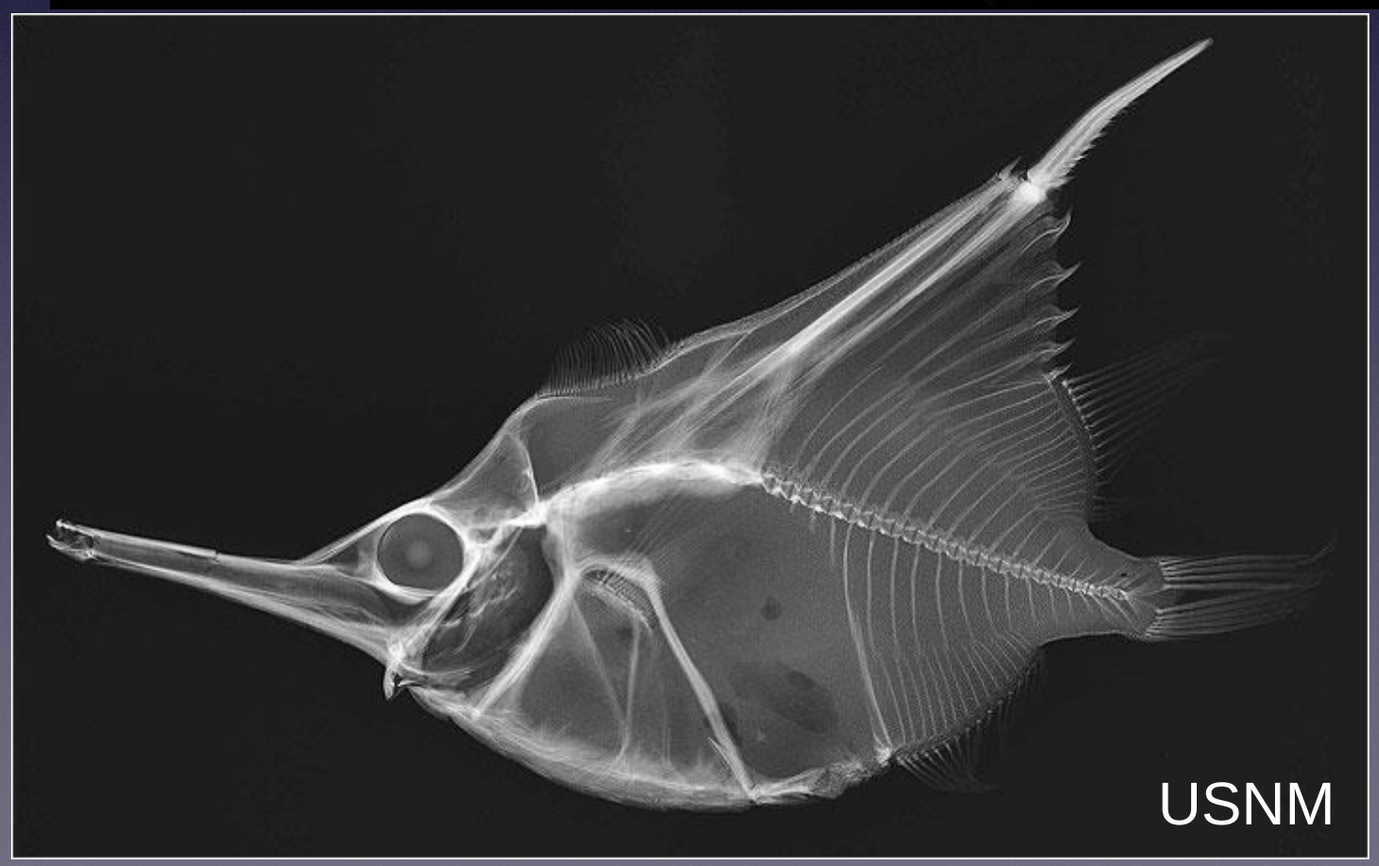
Other ways of imaging fish specimens…

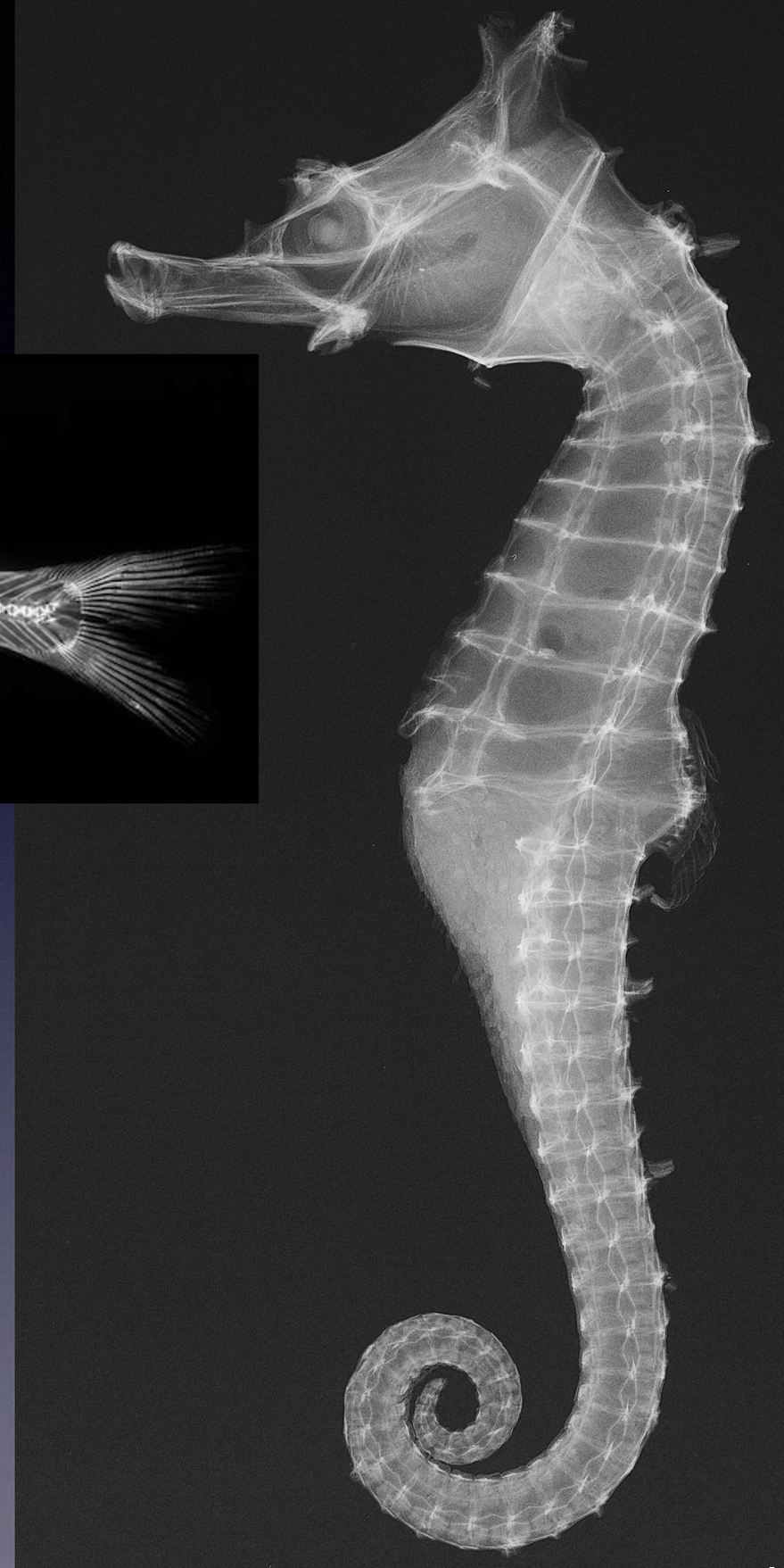
Longitudinal section 3, x32, female

http://theses.vet-alfort.fr/Th_multimedia/medaka/htm/CTA/transversesections.htm

Radiographs

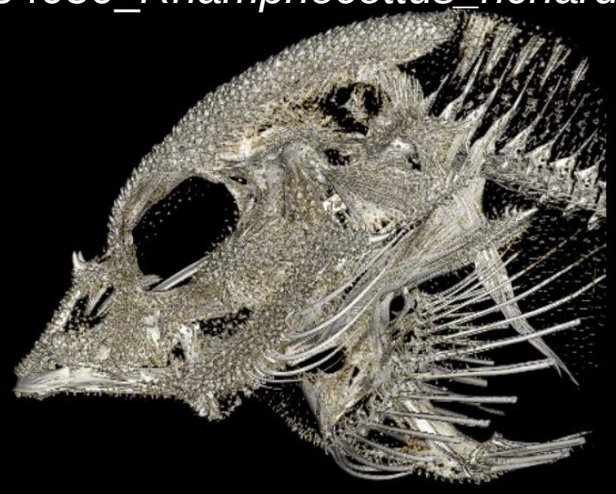






X-ray CT (Stacey Farina's sculpins)

CU54050_*Rhamphocottus_richardsonii*

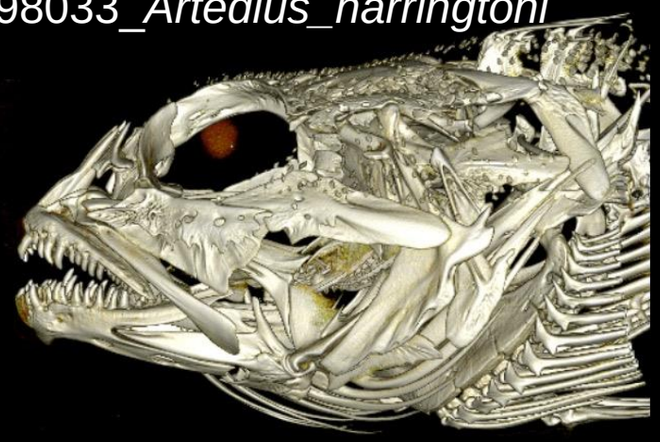


CU98019_*Leptocottus_armatus*

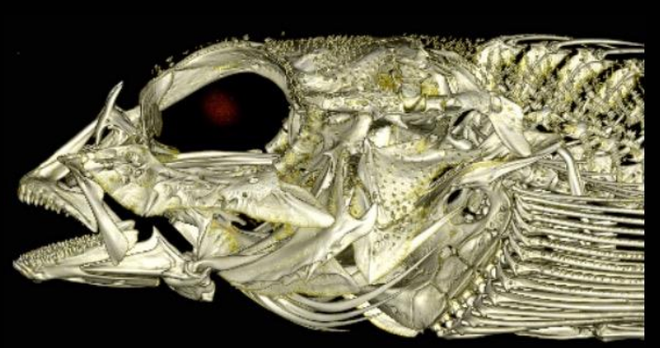
CU98035_*Artedius_lateralis*

CU97981_*Liparis_dennyi*

CU98033_*Artedius_harringtoni*

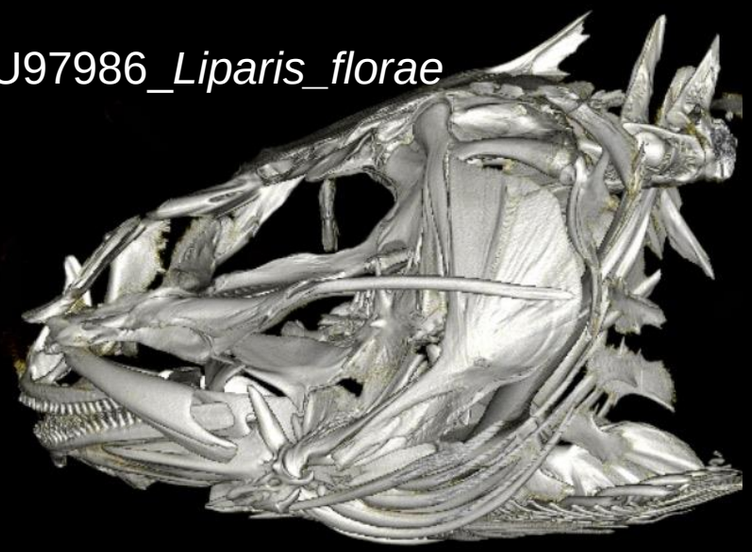


CU97998_*Jordania_zonope*

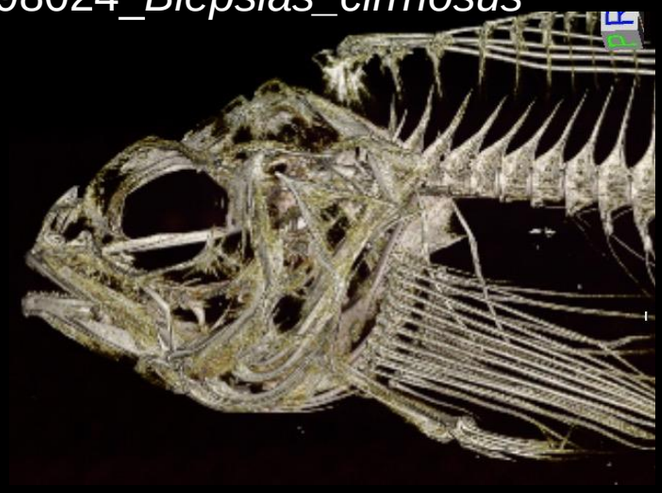


CU97975_*Dasycottus_setiger*

CU97986_*Liparis_florae*



CU98024_*Blepsias_cirrhosus*



whole specimen photographic images

- useful
- easy
- boosts self-esteem

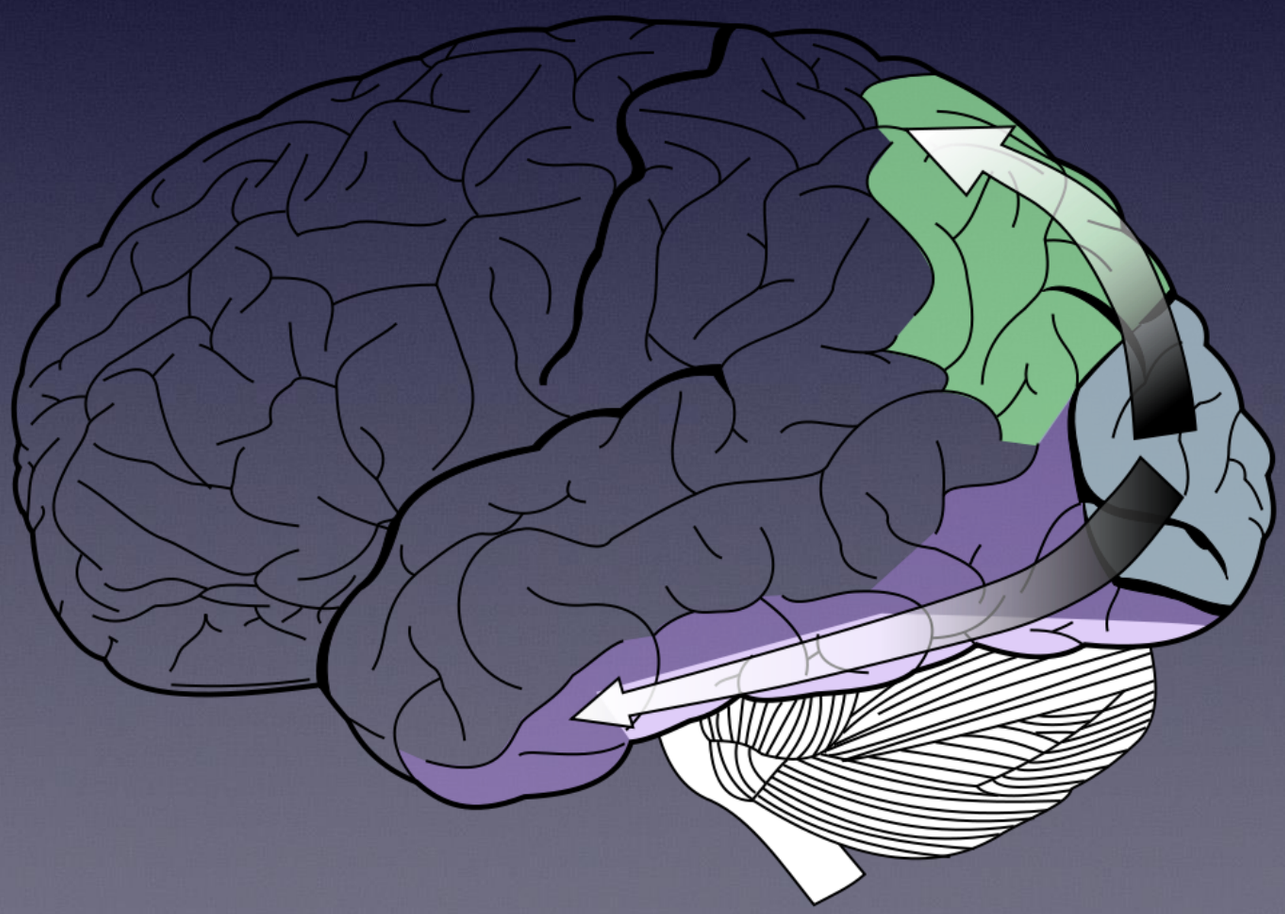
Phractura fasciata, 118 mm SL, CUMV 96006, UNIKIS-10-059, Wagenia rapids, Kisangani, Province Orientale, D.R. Congo, 13-Aug-2010

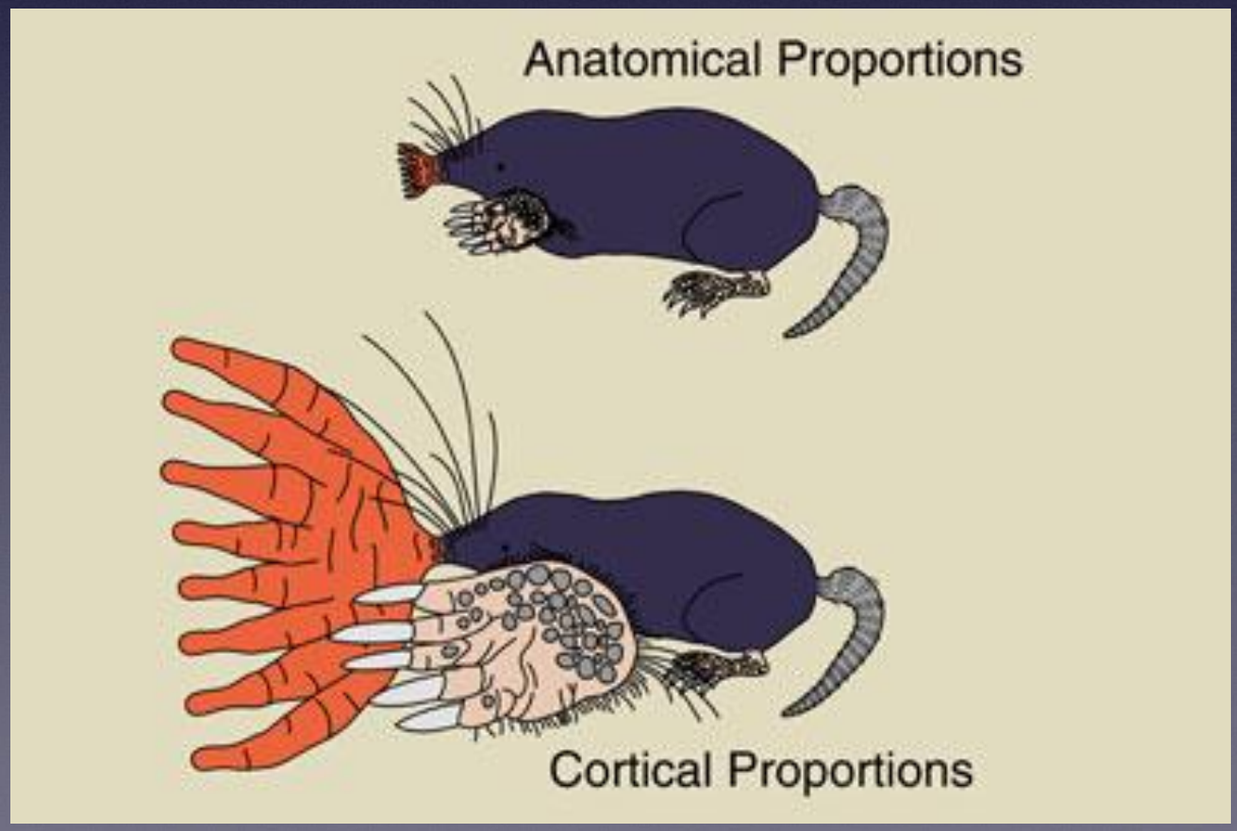
The Value of Imaging in Ichthyology

- We are visual creatures
- Specimen photography has become a necessary skill
- Images communicate & preserve important information about specimens, facilitating discovery & research
- Images reduce wear and tear to specimens
- Images important for teaching & outreach to general public

The Value of Imaging in Ichthyology

- We are visual creatures





1 cm

1192

1117

1201

1175

1214

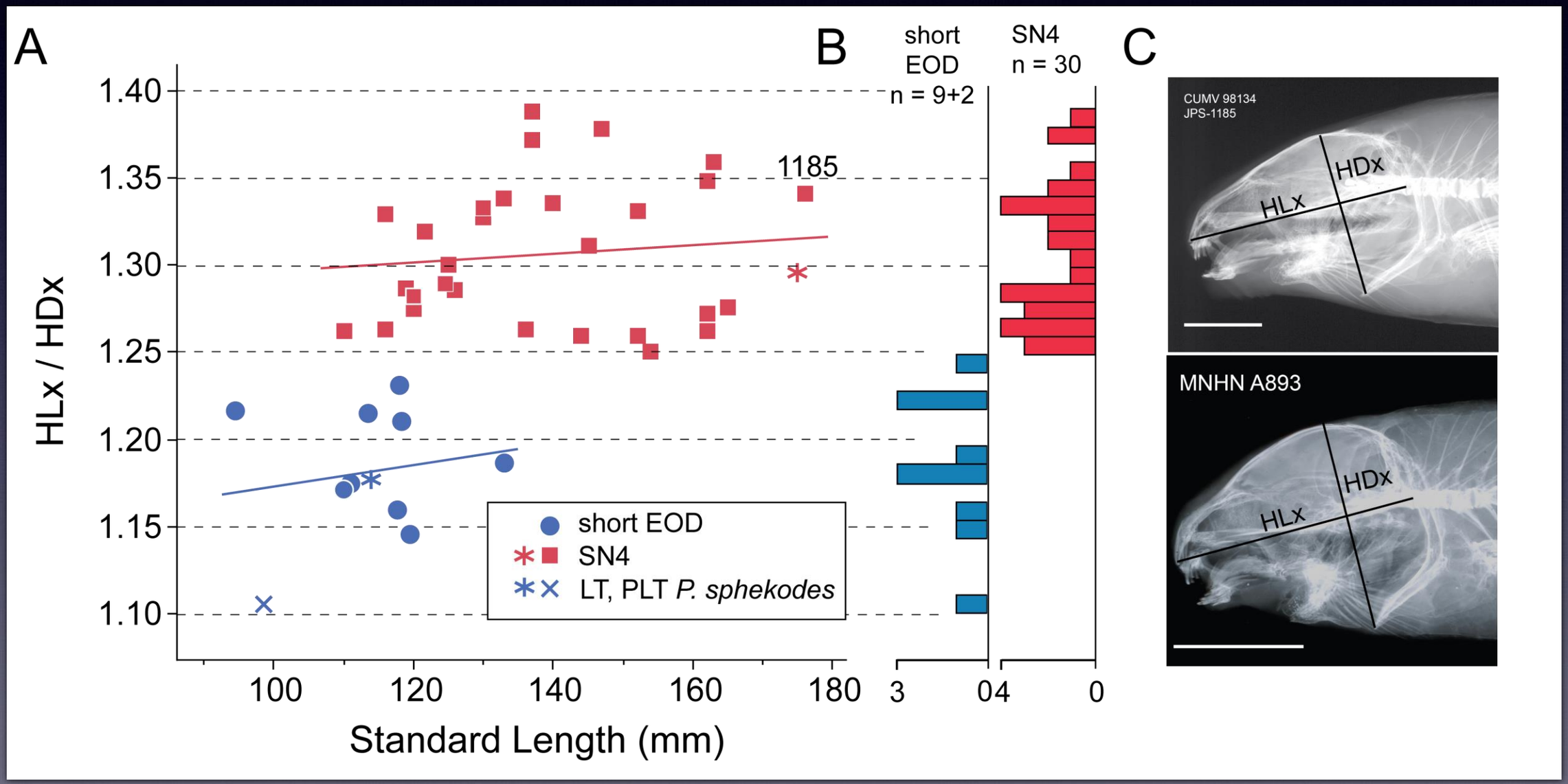
1176

1230

1185

1238

1187


A
B
C
short
EOD
n = 9+2
SN4
n = 30
1185
HLx / HDx
1.40
1.35
1.30
1.25
1.20
1.15
1.10
100
120
140
160
180
3
04
0
Standard Length (mm)
short EOD
SN4
LT, PLT P. sphekodes
CUMV 98134
JPS-1185
HDx
HLx
MNHN A893
HDx
HLx

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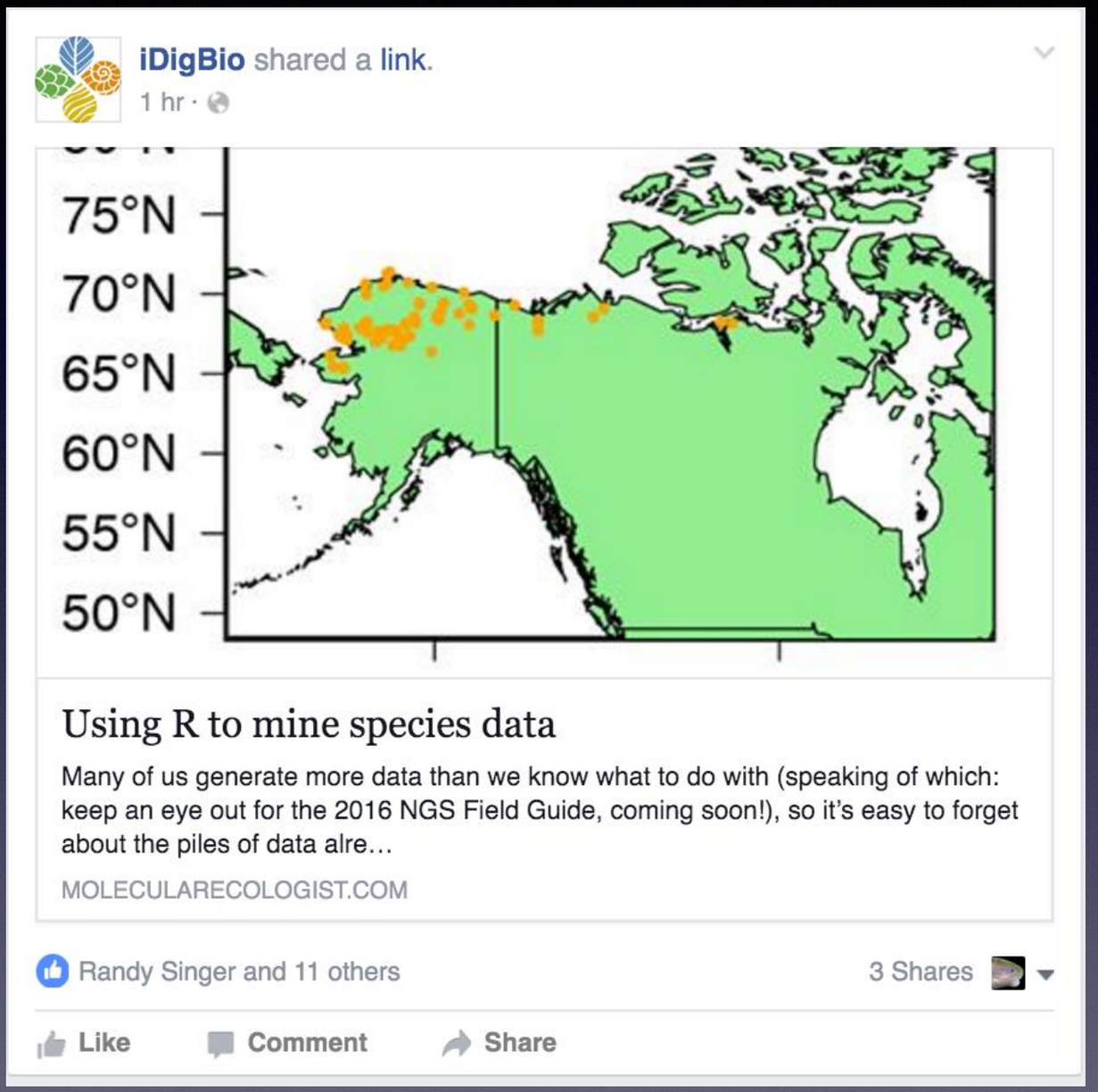
21st Century skills for organismal biologists

databases



programming languages

illustration

Top, Epinephelus fuscoguttatus *(brown-marbled reefcod); right,* Cephalopholis hemistictus *(grouper), both from Rüppell, 1826 (52). Below and bottom,* Epinephelus lanceolatus *(giant grouper), from Day, 1865 (15).*

Top, Epinephelus falvocaeruleus *(blue-and-yellow grouper), from Bennett, 1830 (4). Center,* Cephalopholis leopardus *(red-spotted rockcod); bottom,* Cephalopholis urodelus *(banded-tail coralcod), both from Garrett and Günther, 1873-1910 (27).*

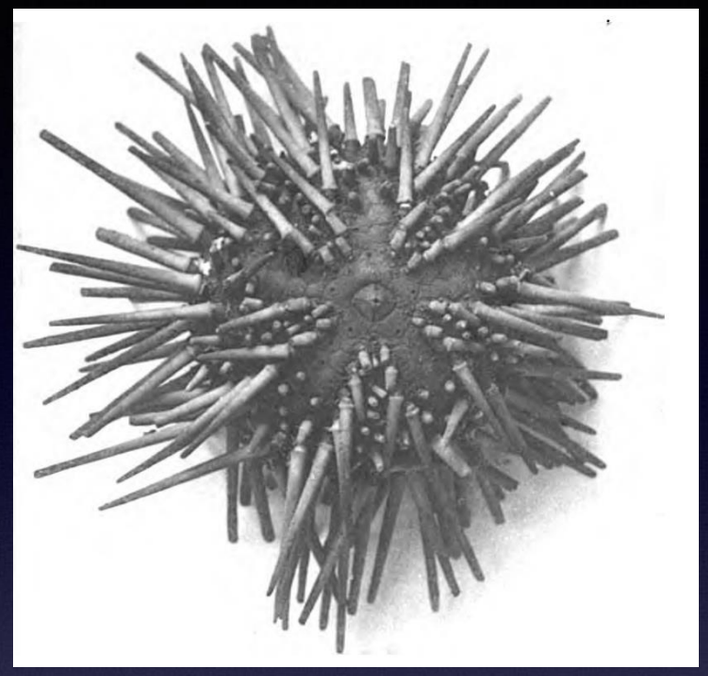
When did photography largely replace illustration?

Alexander Agassiz 1871

~~No. 2.~~ — *Application of Photography to Illustrations of Natural History. With two figures printed by the Albert and Woodbury Processes.*

No attempts have thus far been made to apply the comparatively new processes of carbon printing to general illustrations of Natural History, though excellent figures of microscopic preparations have been printed by carbon processes by Deane, Woodward, and others. The lithographic plates of many memoirs on natural history have been made up with the assistance of photographs, but the want of permanence of the common photographic prints has prevented their use beyond that of auxiliaries to lithography. The rapid progress made in carbon printing by the Woodbury and Albert processes promises to furnish us, within a short time, the means for direct application of photography to illustrations of natural history, and these new methods of printing are likely to replace to a great extent the ordinary lithographic plates.

The accuracy of a photographic illustration is of course far beyond that of an engraving or lithograph, and as soon as a few practical difficulties of printing the separate figures of a plate at one impression are overcome, we shall be able to illustrate our memoirs accurately and economically, and give figures with an amount of detail which the great expense of engraving or lithographing would usually make impossible, even were it mechanically practicable.



When did photographs replace illustrations?

the fish kill resulting from the 1950 eruption of Mauna Loa.)

MATERIAL EXAMINED

I examined 12 specimens, 50 to 165 mm. SL.

Holotype

ZSZM H 398 (112 mm. SL), New Guinea.

Other Material

BMNH 1879.5.14.164–5 (1 specimen, 107 mm. SL; herein designated as the lectotype of *Propoma roseum*), off Kai Islands, *Challenger* station 192.[5] ..... BMNH 1968.8.1.2 (1, 105; the paralectotype of *P. roseum*) from same station

[5] Günther (1880) gave the following for *Challenger* station 192: off Kai Islands, 129 fath. Tizard, Moseley, Buchanan, and Murray (1885: 556) stated "The two trawlings, taken in 129 to 140 fathoms (Station 192). . ." and on p. 1012 (op. cit.) gave the data for *Challenger* station 192 as lat. 5° 49′ 15″ S., long. 132° 14′15″ E., 140 fath., September 26, 1874. According to U.S. Naval Oceanographic Office chart H.O. 5592, this position is in the Kai Islands—ca. 7 nautical miles SE. of Taam and ca. 13 nautical miles NW. of Kai Tanimbar.

SYMPHYSANODON KATAYAMAI NEW SPECIES

Figure 2; tables 1 to 4

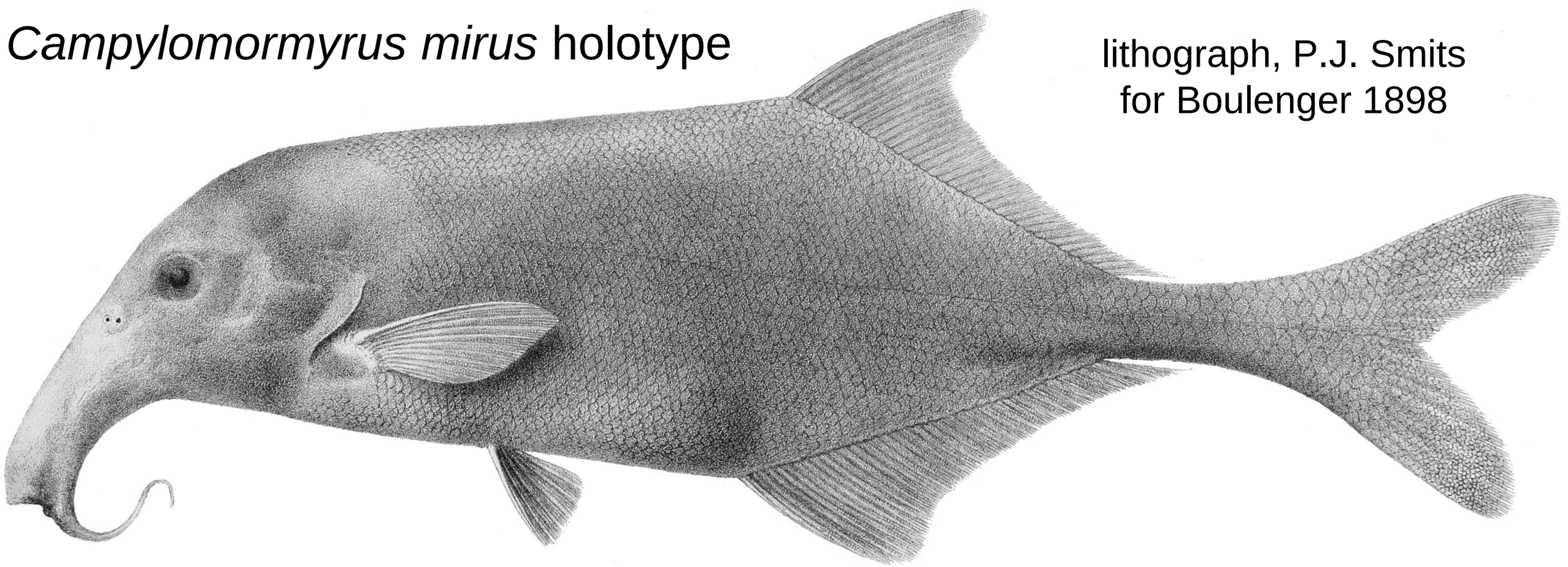
Symphysanodon typus (non Bleeker, 1878), Kamohara and Katayama, 1959: 2, fig. 2 (synonymy in part of *S. typus* and in part of *S. maunaloæ;* description and illustration representing *S. katayamai* from Japan; distribution referring in part to *S. typus,* in part to *S. maunaloæ,* and in part to *S. katayamai*). ..... Katayama, 1960: 168, pl. 86 (synonymy referring in part to *S. typus,* in part to *S. maunaloæ,* and in part to *S. katayamai;* description and illustration representing *S. katayamai;* distribution referring in part to *S. typus,* in part to *S. maunaloæ,* and in part to *S. katayamai*). ..... Anderson, 1967: 2, 11 (compiled meristic data referring in part to *S. typus,* in part to *S. maunaloæ,* and in

FIGURE 2.—Holotype of *Symphysanodon katayamai* (ZIKU 8206), 163 mm. SL.

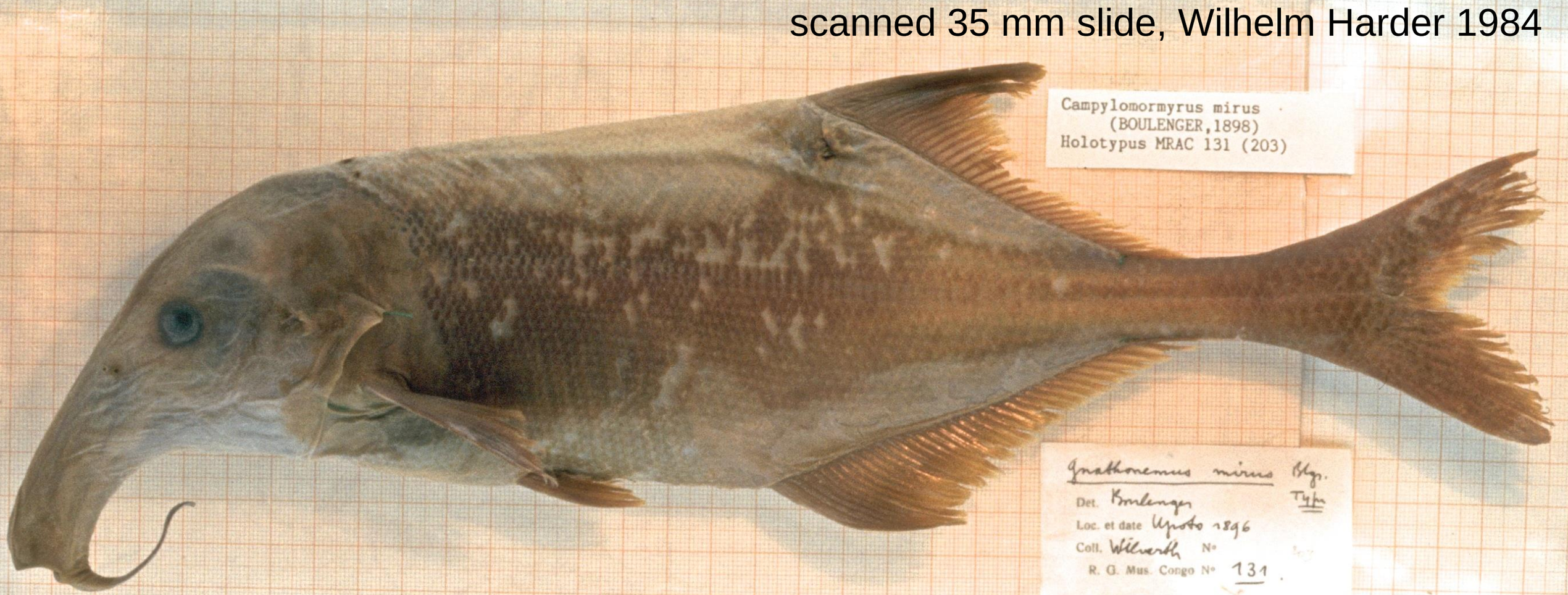
Anderson, W. D., Jr. 1970.
Revision of the genus *Symphysanodon* (Pisces: Lutjanidae) with descriptions of four new species. United States National Marine Fisheries Service Fishery Bulletin v. 68 (no. 2): 325-346.

Campylomormyrus mirus holotype

lithograph, P.J. Smits
for Boulenger 1898



scanned 35 mm slide, Wilhelm Harder 1984



Cowcod - *Sebastes levis* (Eigenmann & Eigenmann, 1889)

FEATURES: Color highly variable; capable of rapid change. Whitish, pinkish, orange, or yellowish, with four or five narrow, faint to dark bars on sides. Bars distinct in juveniles, fade with age. Lower jaw with knob under tip. Eyes comparatively small. First dorsal fin deeply incised. Second anal-fin spine about as long as third. Body deep, robust. HABITAT: Newport, OR, to central Baja California. Found demersally over soft, mixed, hard, and complex bottoms with caves, crevices, and other shelter from about 130 to 1,610 ft. BIOLOGY: Usually solitary, but may congregate. Feed on a variety of invertebrates and fishes. May live to 55 years. Populations low due to overfishing.

Mexican Rockfish - *Sebastes macdonaldi* (Eigenmann & Beeson, 1893)

FEATURES: Mottled reddish black dorsally, becoming reddish below. Larger specimens sometimes with irregular pale blotches on back and sides. Bars may radiate from below eyes. Lateral line pink to pinkish red. Lower jaw protrudes; knob at tip present. A flat, rear-facing spine is present below anterior portion of eyes. Maxilla extend to near rear of eyes. Anal fin with seven to eight rays; second spine shorter than third. HABITAT: Point Sur, CA, to southern Baja California, and central Gulf of California. Occur over rocky outcrops and oil platforms from about 250 to 1,150 ft.

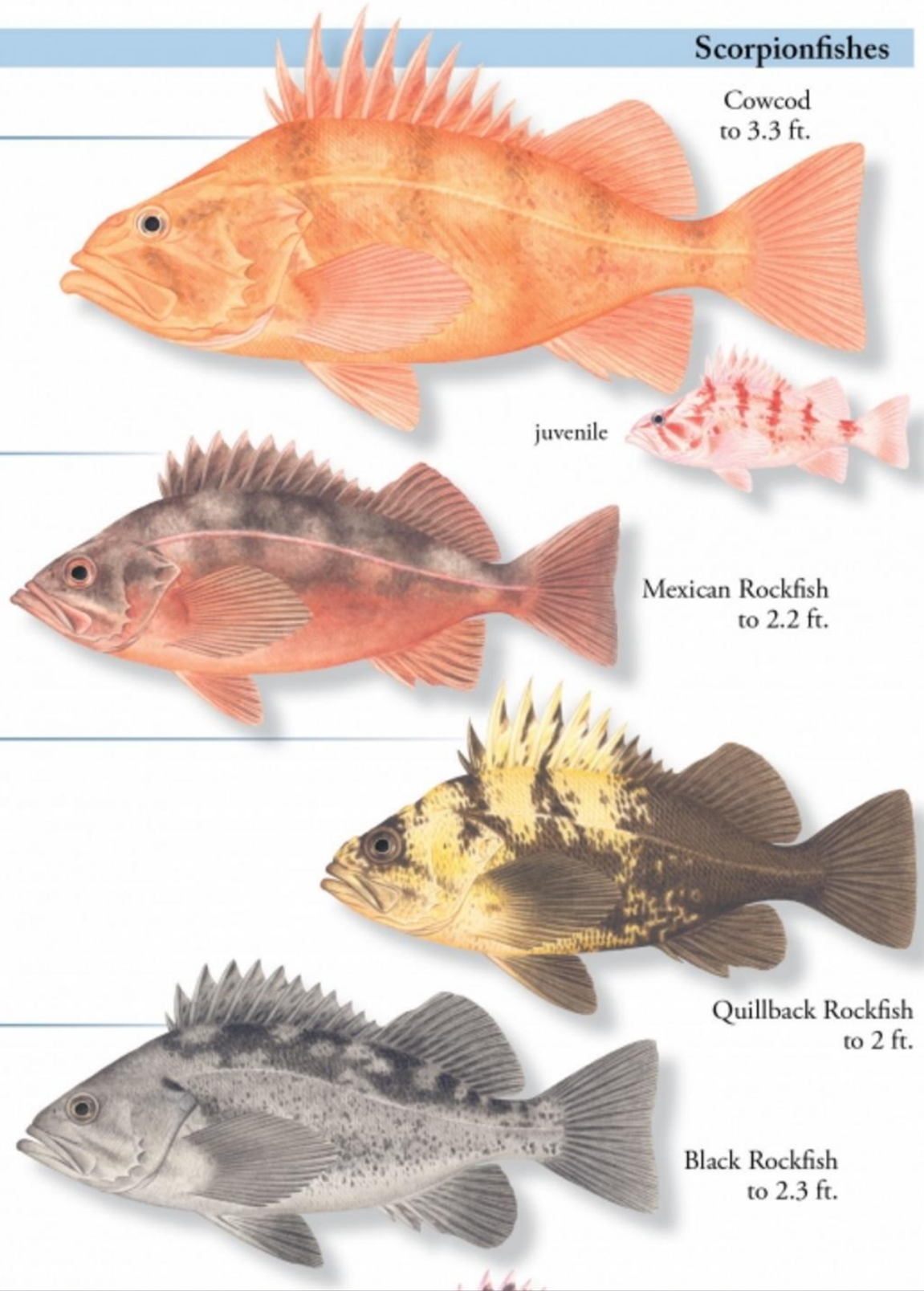
Quillback Rockfish - *Sebastes maliger* (Jordan & Gilbert, 1880)

FEATURES: Brownish with a large area of yellow on head, irregular yellowish blotches on back that extend into spiny dorsal fin, and a few yellowish speckles on posterior body. Lower jaw protrudes slightly. Maxilla extends to rear of eyes. Spiny dorsal fin tall with deeply incised membranes. Anal fin with six to seven rays; second spine longer than third. HABITAT: Kodiak Island, AK, to southern CA at Anacapa Passage. Found demersally over low- and high-relief rocky bottoms from intertidal zone to about 900 ft. BIOLOGY: Occupy home ranges. May be territorial. Often solitary.

Black Rockfish - *Sebastes melanops* Girard, 1856

FEATURES: Gray, with blackish speckles and mottling dorsally. Pale ventrally. Dark speckles extend into dorsal fin. Some with dense speckles on lower sides that form a loose stripe. Faint dark band may radiate from below eyes. Lower jaw protrudes slightly; knob at tip absent. Maxilla extend to rear of eyes. Head spines reduced to almost absent. Anal fin rounded at lower edge. HABITAT: Amchitka Island, AK, to Huntington Beach, CA. Found demersally to near surface over high-relief rocky bottoms to about 1,200 ft. BIOLOGY: Form small to large schools. May leap from water in pursuit of prey.

Semaphore Rockfish - *Sebastes melanosema* Lea & Fitch 1979



Before digital: 35 mm film photography

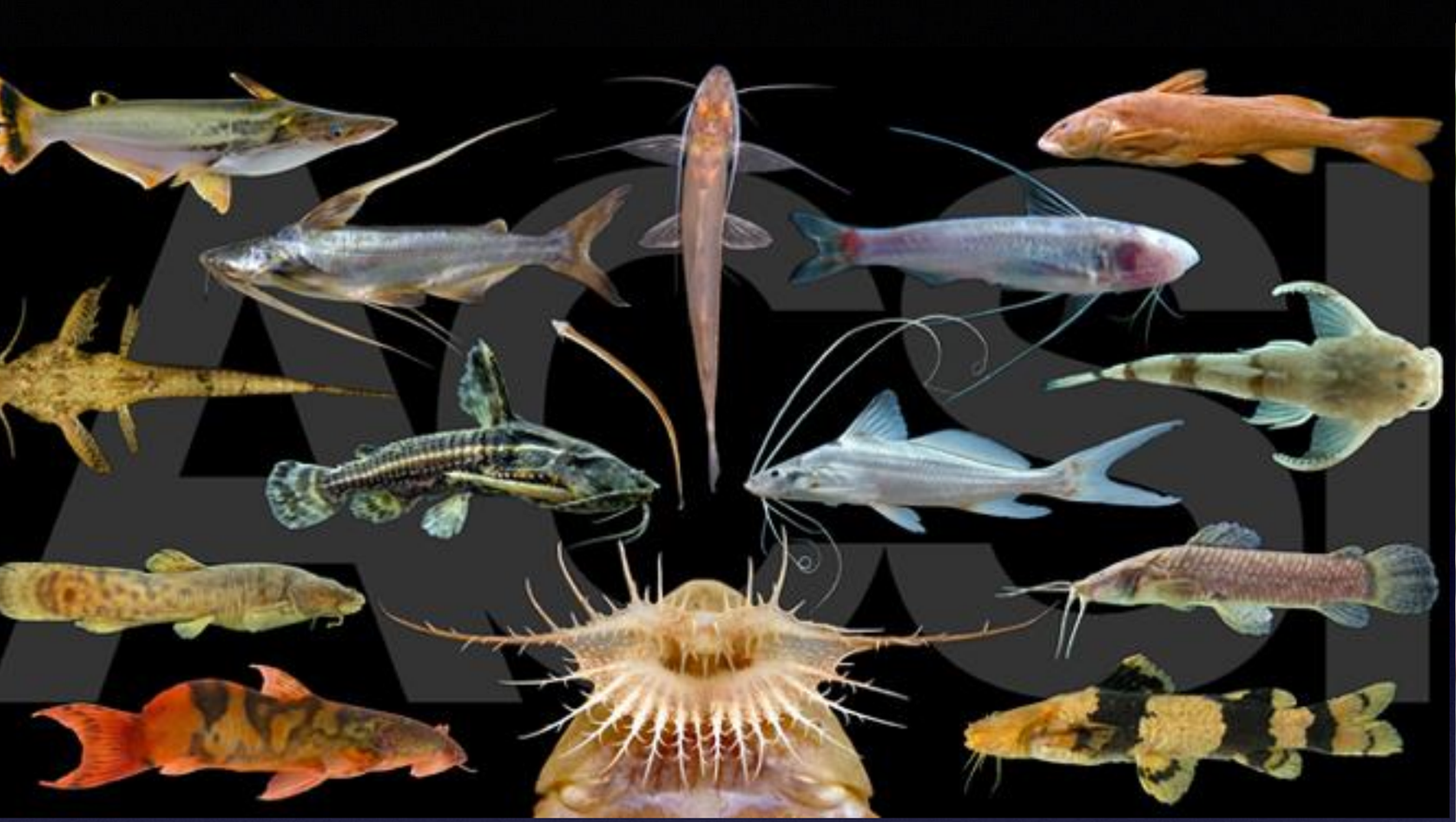
Paramormyrops sp. “teugelsi”

Paramormyrops sp. “SP9”

- dozens of exposures to get a few keepers

Age of digital photography

Gnathonemus petersi



Mark Sabaj Pérez

Kyle Luckenbill

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The Value of Imaging in Ichthyology

- color (live/preserved)
- size
- shape
- homologous points
- fins
- scales

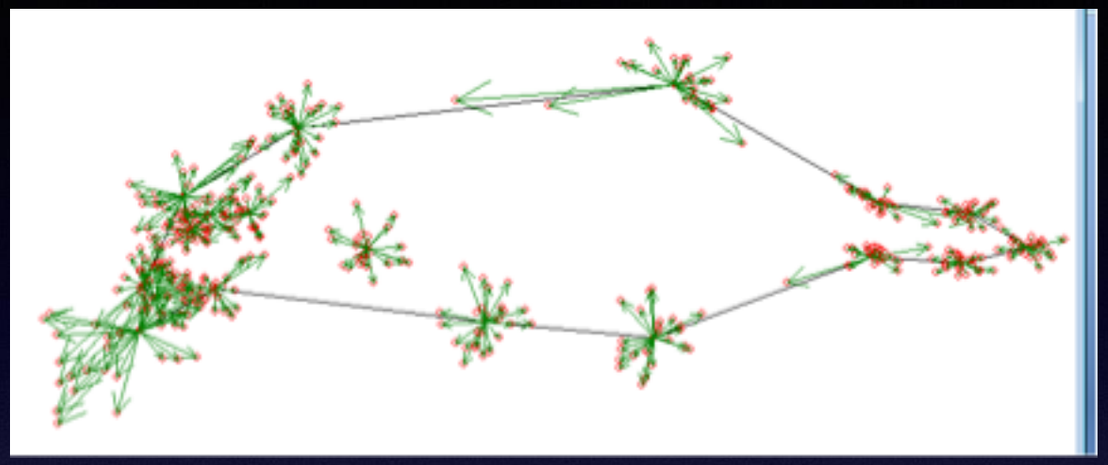
preserved

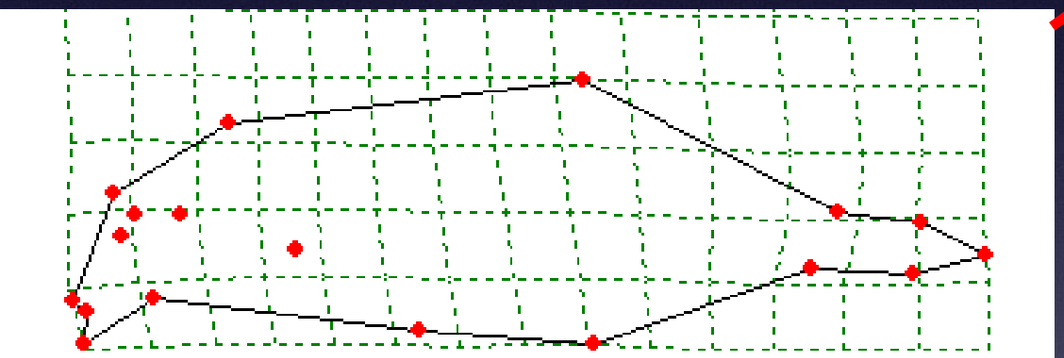
Color

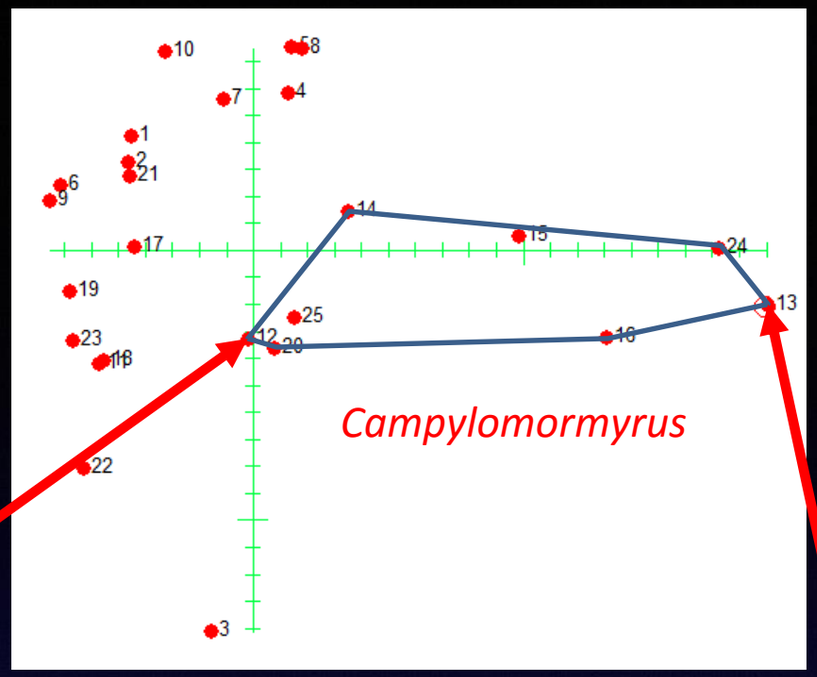
live

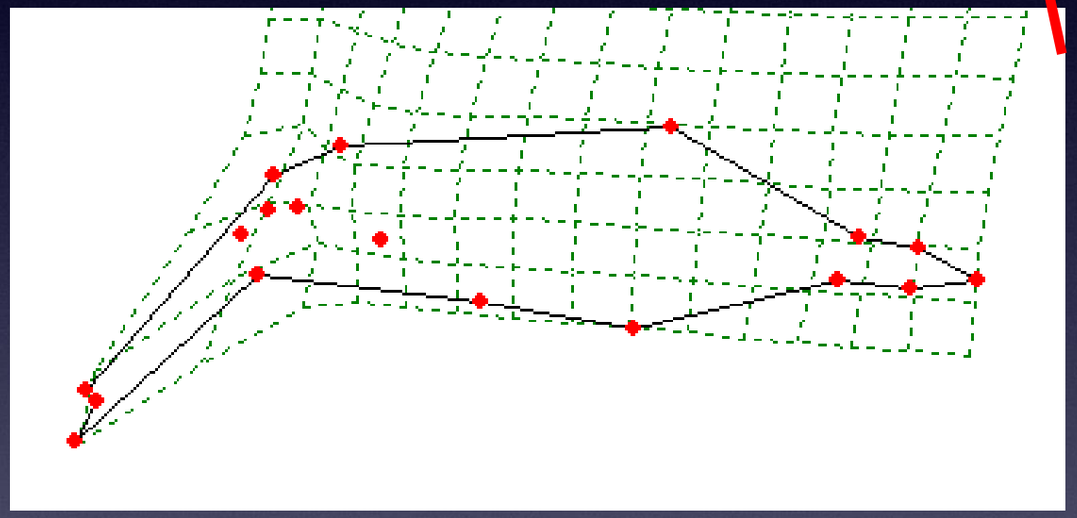
Brachyhypopomus walteri Sullivan, Zuanon & Cox Furnandes 2013 holotype

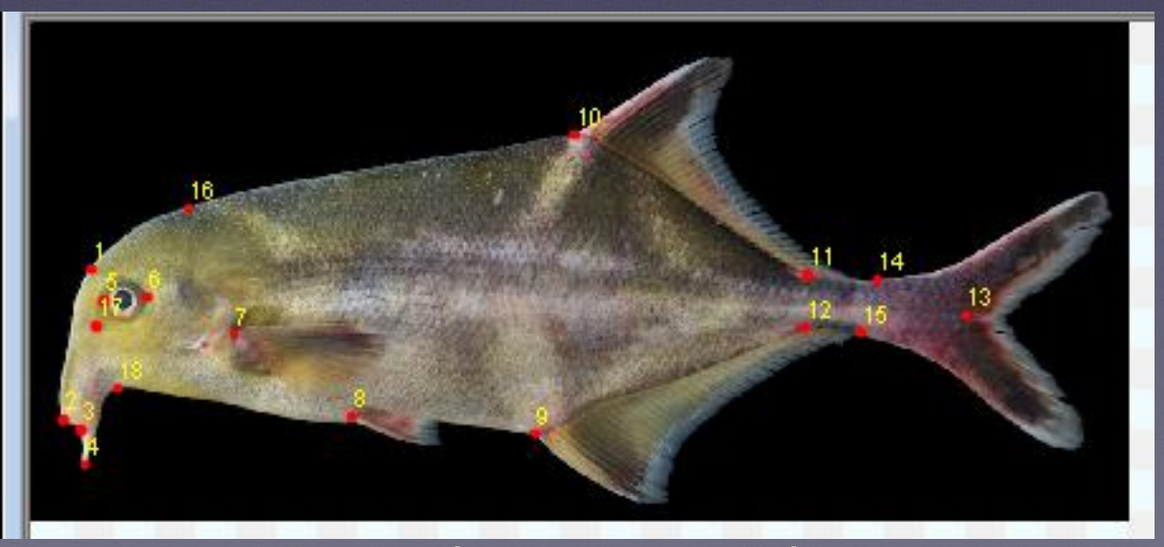
size/shape/homologous points



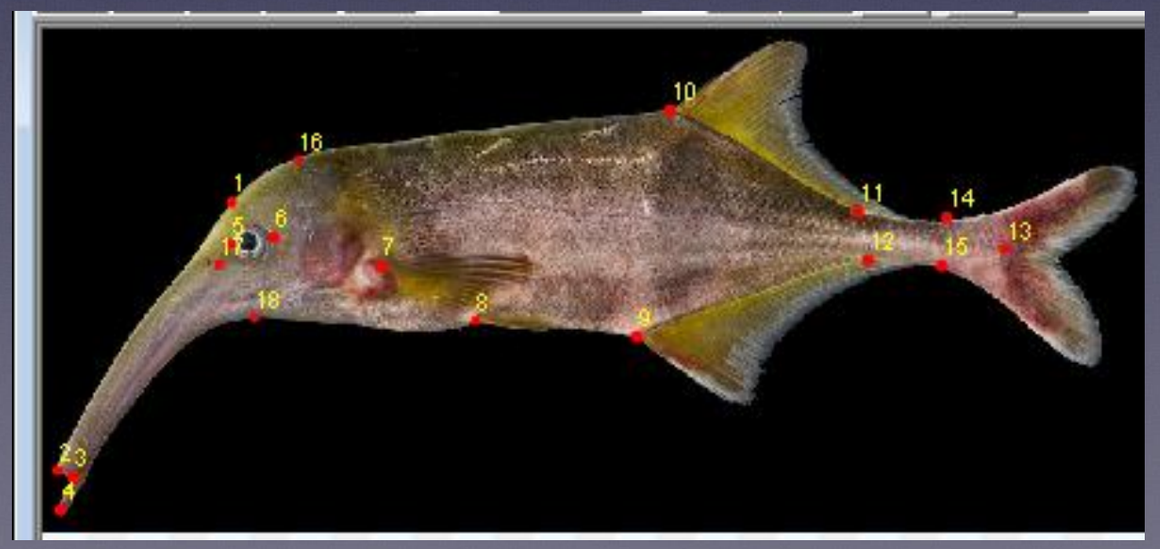








Campylomormyrus alces



Campylomormyrus numenius

fins/scales

Congochromis squamiceps CUMV 96716

wear & tear on specimens

1984

A

2003

Paramormyrops sphekodes Sauvage 1879 holotype MNHN A.893

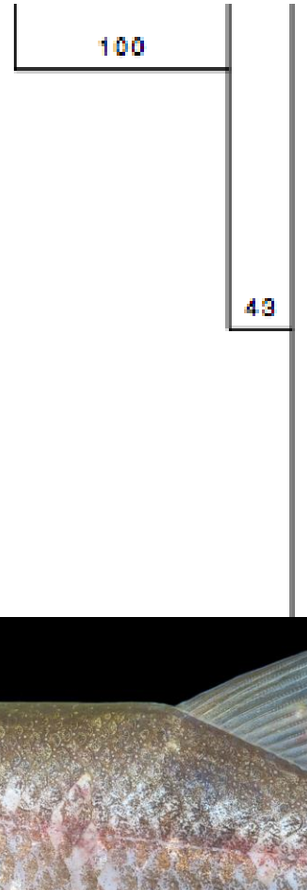
Specimen images facilitate discovery & research

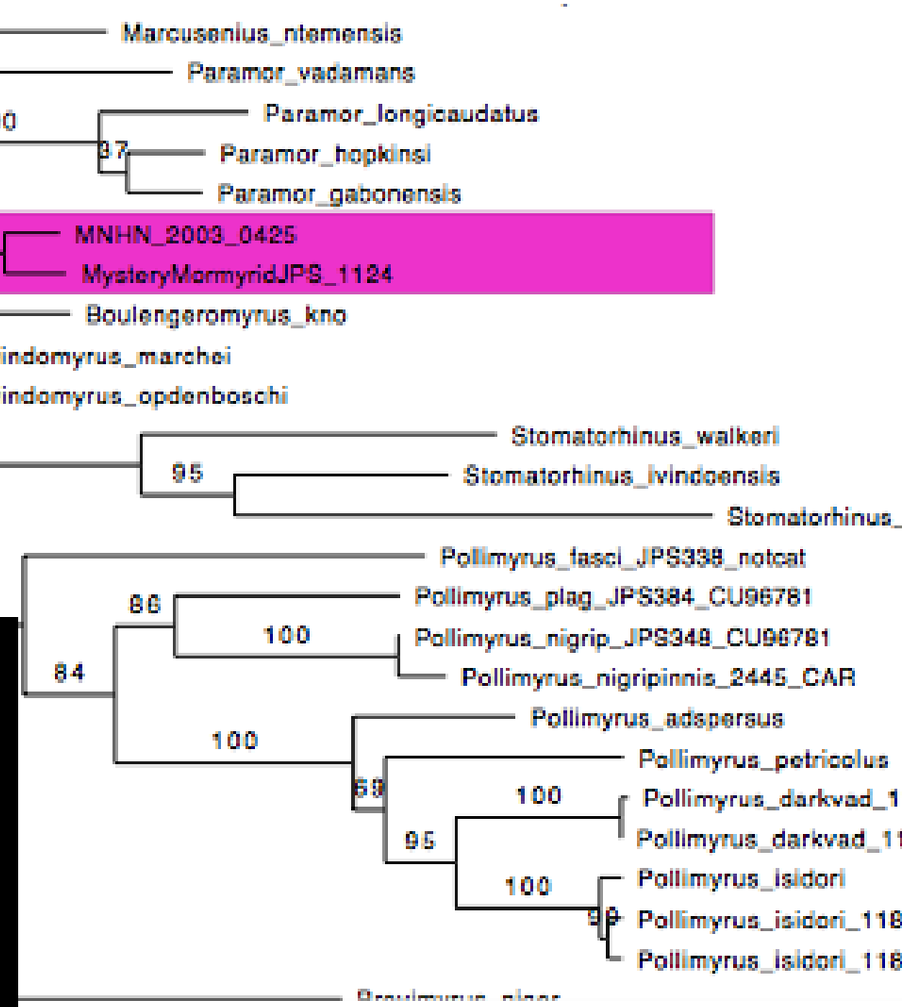
• “Images of type specimens are essential in describing new species when researchers are geographically removed from the types they need for comparison.” Kyle Luckenbill, ANSP

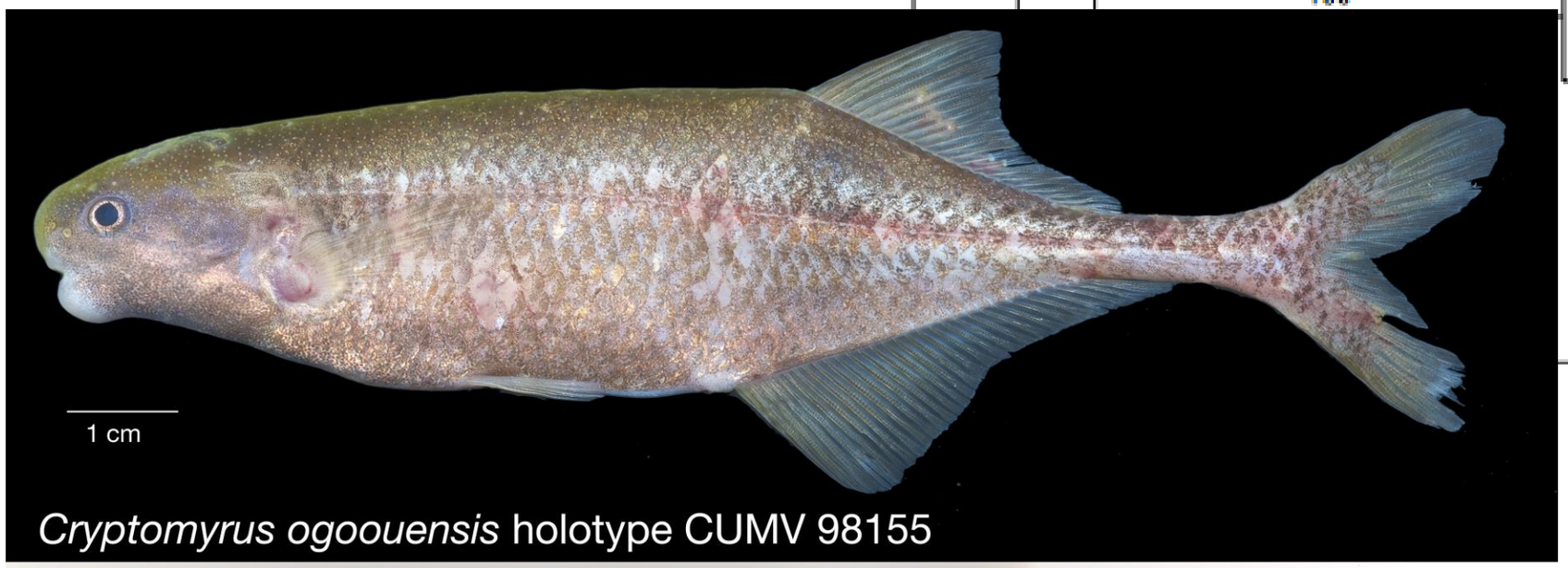
• “Some images generate questions that can lead to studies! For example a few fish I have described were only borrowed and examined because I saw a photo of them.” Randy Singer, UF

Akysis hardmani

Photo by Kyle Luckenbill
Mae Nam Chao Phraya and tribs in vicinity of Phayuha Khiri, Nakhon Sawan, Thailand
Holotype, ANSP 178858, Ng & Sabaj, 2005
34.5 mm SL







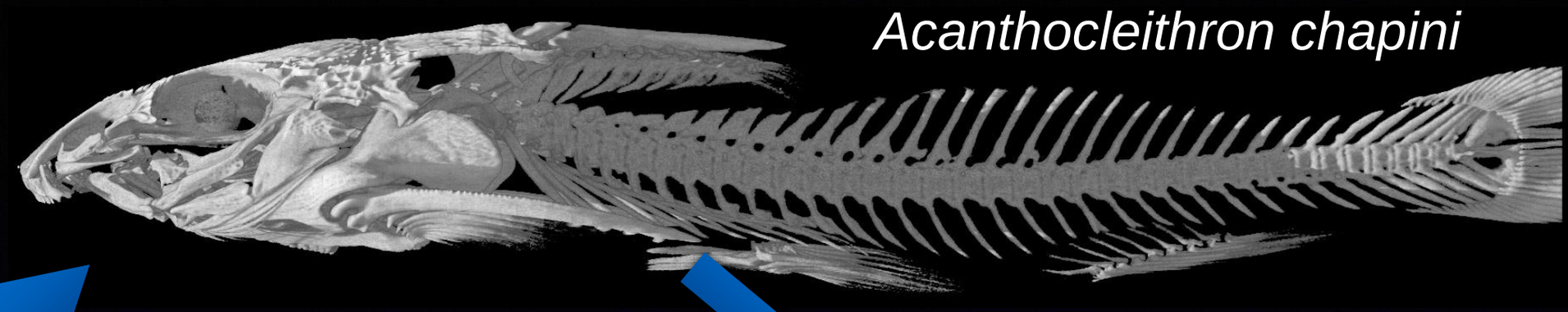
Cryptomyrus ogoouensis holotype CUMV 98155

Cryptomyrus ona holotype MNHN 2003-0425

Discovery: new mormyrid genus

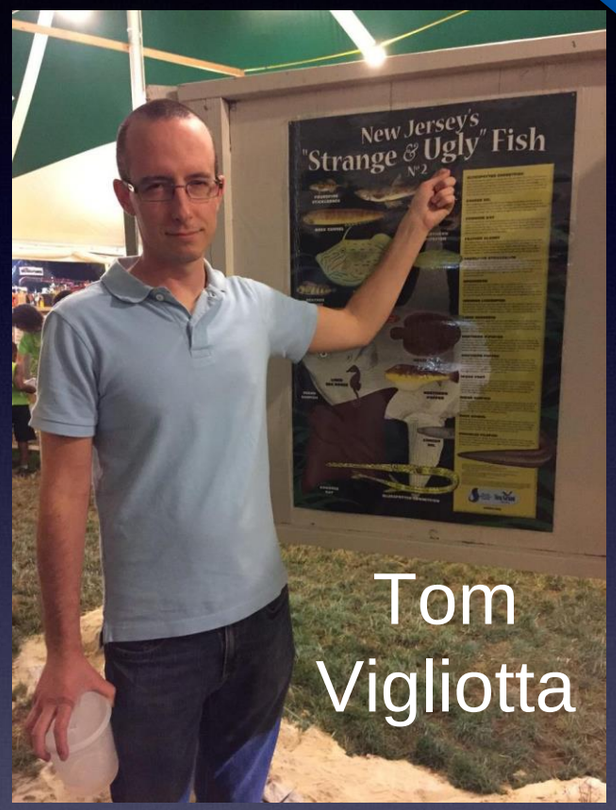
Sullivan, Lavoué & Hopkins 2016

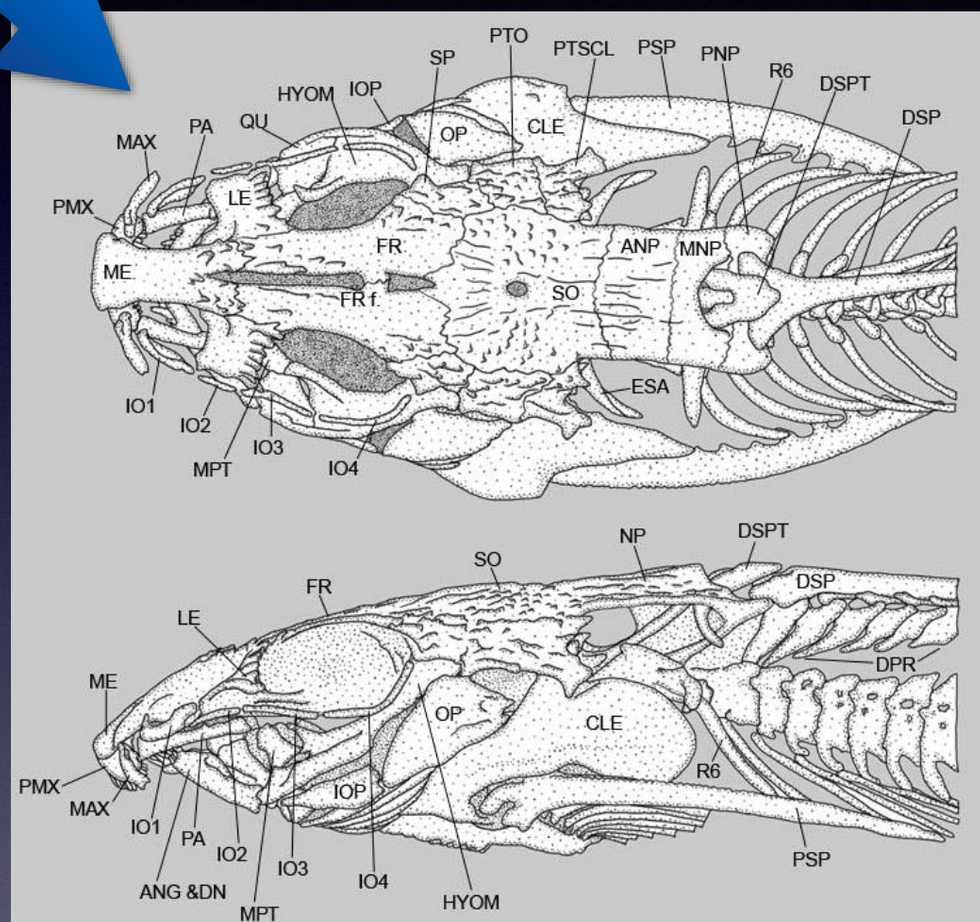
Facilitates research



Acanthocleithron chapini

Vigliotta 2008





Vigliotta 2008

"When working on mochokid phylogeny, I was lucky enough that AMNH let me get one of their type series of *Acanthocleithron chapini* scanned by the folks at Digimorph. At that time there wasn't really that much material available, and I probably wouldn't have been able to C&S any of it. The work relied heavily on skeletal features. The scan allowed me to include a unique (morphologically speaking) and monotypic genus in the analysis."

online image archives

www.morphbank.net/myCollection/?id=464608

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User: Guest [click to login]

About | Browse | Tools | Help

My Collections/Characters (Need Help...) (Feedback...)

Antennarius ([20] images)

Image Size: 80 **Post It:** On Off | **Icons:** On Off

Check All | Uncheck

Specimen 112786	Specimen 112832	Specimen 112921	Specimen 112959	Specimen 112977	Specimen 113287	Specimen 113691	Antennarius moai
Antennarius coccineus	Antennarius commerson	Antennarius coccineus	Antennarius drombus	Antennarius nummifer	Antennarius pictus	Specimen 115663	Specimen 115745
Specimen 115845	Specimen 115870	Specimen 116158	Antennarius coccineus				

Morphbank

Siluriformes

Note: Types are in the current family of their original genus. For each genus: click on generic name for list of species and click on (images) for list of all images.

All Catfish Species Inventory Image Base

Images of catfish submitted by ACSI Participants:

PDF documents related to catfish submitted by ACSI Participants:

If you would like to cite the ACSI Imagebase in a publication please use the citation: *Morris, P.J., H.M. Yager, [programmers] and M.H. Sabaj Pérez [editor], 2006. ACSImagebase: A digital archive of catfish images compiled by participants in the All Catfish Species Inventory. [WWW image Database] URL http://acsi.acnatsci.org/base . If you cite individual images in the image base, please credit the people and institutions who provided the images.*

Summary as of 2016 03 27, 02:03 EDT

Total images: 9967

Total institutions represented: 60

ACSI Image Base

Summary as of 2016 03 27, 02:03 EDT

Total images: 9967

Total institutions represented: 60

Total photographers: 92

Total submitters: 51

Total type specimens: 2804

Total images of types: 9433

Images of types by kind of type:
Holotype: 4465
Syntype: 4088
Lectotype: 359
Paratype: 273
Paralectotype: 152
Unknown: 67
Neotype: 24
NotProvided: 4
Iconotype: 1

Species represented by type images: 2177

Institutions represented by type images: 53

‘next-gen' collection databases with links to images

arctos.database.museum/guid/CUMV:Fish:91223

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Fish Collection

Cornell University Museum of Vertebrates

Search | Enter Data | Manage Data | Manage Arctos | Reports | Portals | My Stuff | About/Help

CUMV:Fish:91223

collector number: JPF-0356; JPF-0374

Campylomormyrus elephas

get a DOI

Samfa Rapids at pontoon on Chambeshsi River
Africa, Zambia, Northern Province
2005-10-11

tissue (95% ethanol); whole organism (ethanol); tissue (95% ethanol)

[Report Bad Data]
collection

Identification | Accn | Locality | Agents | Parts | Part Locn. | Attributes | Other IDs | Media | Encumbrances

Edit

Campylomormyrus elephas
Animalia; Chordata; Actinopterygii; Osteoglossiformes; Mormyridae; Campylomormyrus elephas (Boulenger, 1898)
Norsukala; Rypoun sloní; Sosha; elephant-trunk mormyrid
Identified by John P. Sullivan on 2005-10-11
Nature of ID: legacy

Campylomormyrus mirus
Rypoun podivný
Identified by John P. Friel
Nature of ID: legacy

Edit

Determination Type: accepted place of collection
assigned by unknown on 2014-02-28
Higher Geography: Africa, Zambia, Northern Province more
Specific Locality: Samfa Rapids at pontoon on Chambeshsi River
Collecting Method: dipnets, electrofisher, seines
Collecting Source: wild caught
Event Date: 2005-10-11
Verbatim Date: 2005-10-11
Verification Status: unverified
Coordinates: -10.8521003723 / 31.1672992706
Georeference Source: unknown
Georeference Protocol: not recorded

No Media Found

Collector(s) Edit
Roger Bills, Alex Chilala, John P. Friel

Identifiers Edit
Trapline ID: JPF 05-047
collector number: JPF-0356
collector number: JPF-0374

Edit

Part Name	Condition	Disposition	Qty	Label	Loan	Remarks
tissue (95% ethanol)	unchecked	in collection	10			

Attribute	Value	Date	Dtr.	Rmk.
Other ID	JPF 356			
location	95% ETOH			
location	Flammable Fridge; Door ; Rack ; Box 27; Cell E3			

tissue (95% ethanol)	unchecked	in collection	1			

Attribute	Value	Date	Dtr.	Rmk.
Other ID	JPF 374			
location	Flammable Fridge; Door ; Rack ; Box 27; Cell E4			

whole organism (ethanol)	unchecked	in collection	11			

Attribute	Value	Date	Dtr.	Rmk.
location	ETOH			

Entered By: Dusty L. McDonald on 2014-02-28
Last Edited By: UAM on 2016-03-27
Edit

Accession Edit
2005-XI:07
No Media Found

Media Attach/Upload Media
Showing Media results 1 - 2 of 2 [[view details]


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The Value of Imaging in Ichthyology

- We are visual creatures
- Specimen photography has become a necessary skill
- Images communicate & preserve important information about specimens, facilitating discovery & research
- Images reduce wear and tear to specimens
- Images important for teaching & outreach to general public

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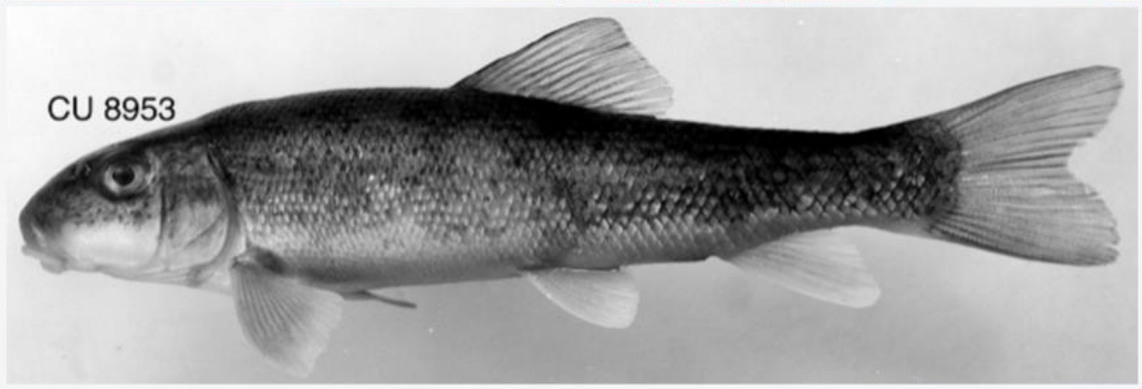
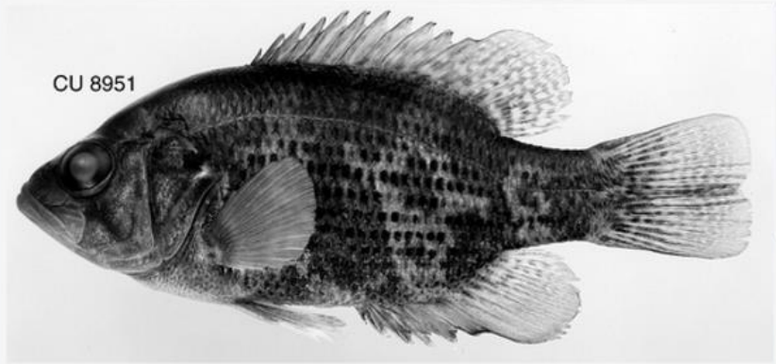
CUMV Fishes

57 photos • 42 views

By: Cornell University Museum of Vertebrates

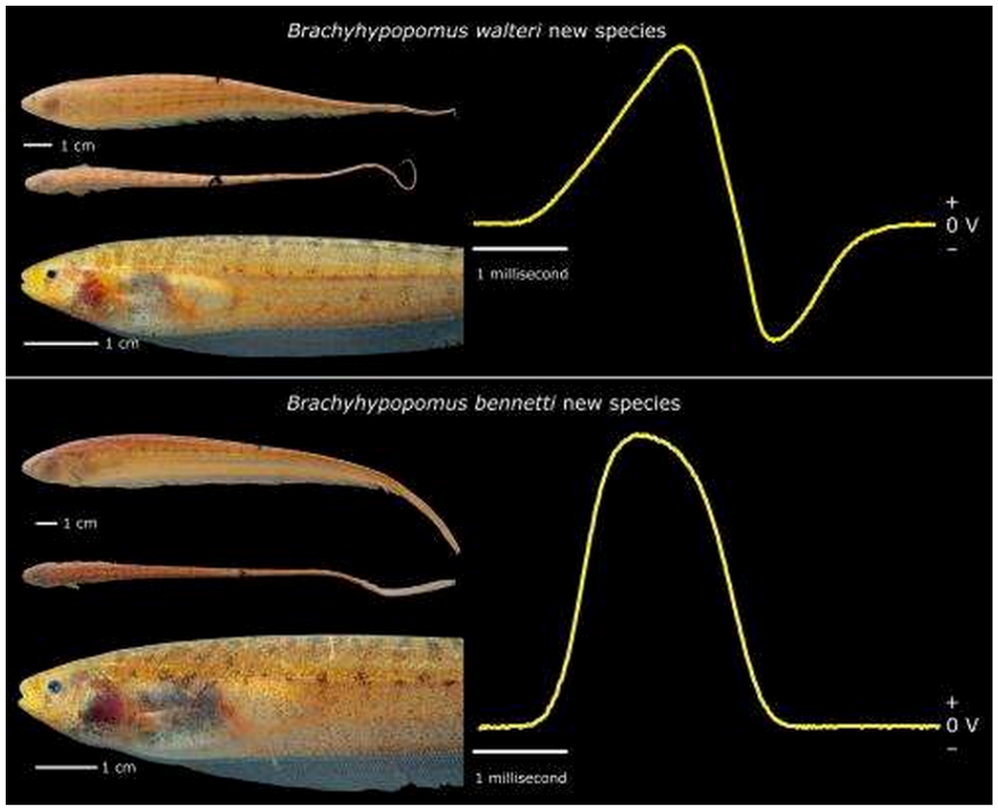




Outreach

AC or DC? Two newly described electric fish from the Amazon are wired differently

Aug 28, 2013



This is an image of the two new species with their electric organ discharges (EODs). Brachyhypopomus walteri (top) has a longer, thinner tail and produces an EOD with both positive and negative phases. Brachyhypopomus bennetti (bottom) has a … more

Much as human siblings can have vastly different personalities despite their similar resemblance and genetics, two closely related species of electric fish from the Amazon produce very different electric signals. These species, new to science, are described in the open access journal *ZooKeys* by Drs. John Sullivan of Cornell University in Ithaca, New York, Jansen Zuanon of the National Amazonian Research Institute in Manaus, Brazil and Cristina Cox Fernandes of the University of Massachusetts, Amherst.

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Outreach

MATTER
Researchers Find Fish That Walks the Way Land Vertebrates Do

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BASICS
Parrots Are a Lot More Than 'Pretty Bird'

Beetle Moms Send a Chemical Signal: 'Not Tonight, Honey'

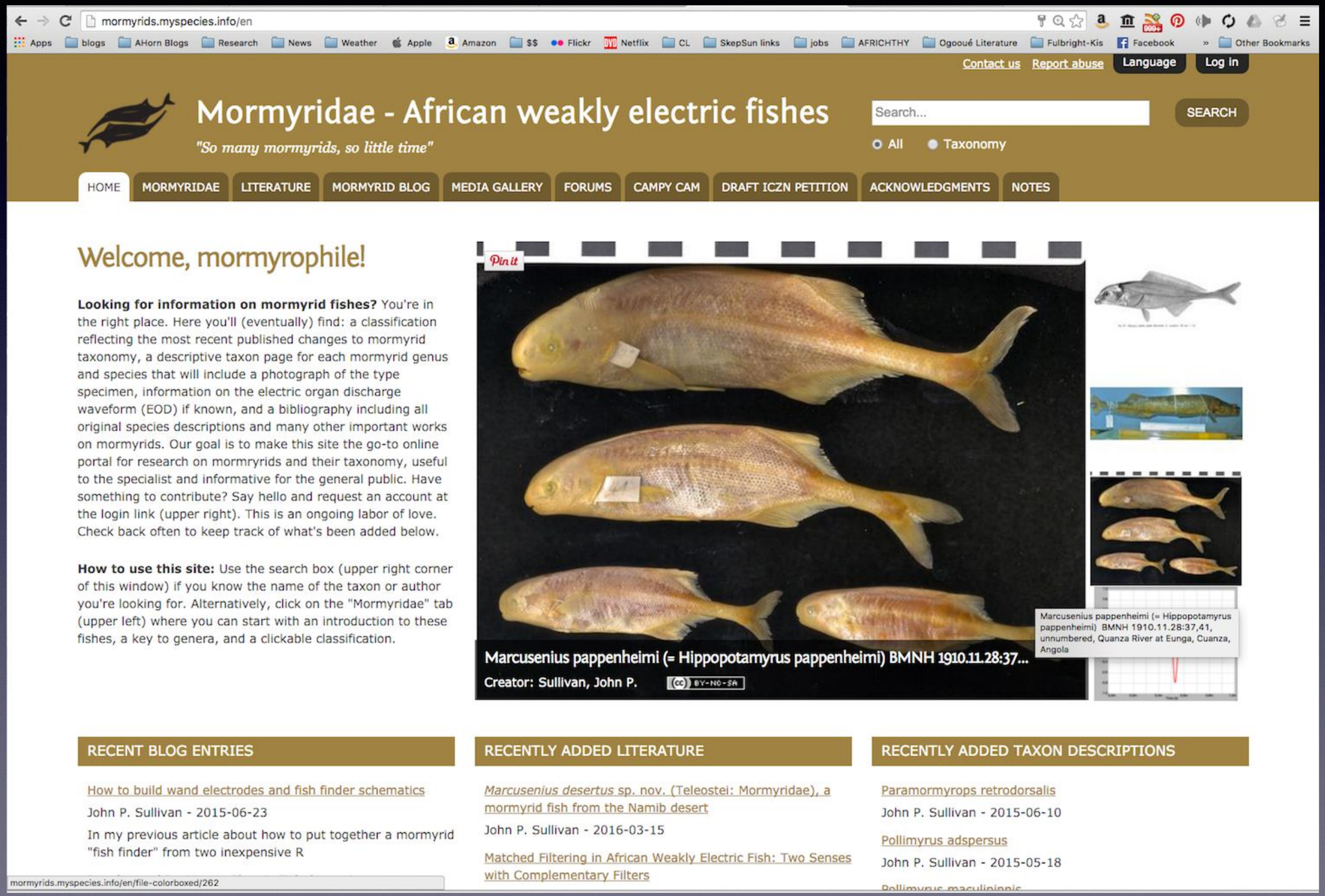
SCIENCE

Researchers Find Fish That Walks the Way Land Vertebrates Do

Carl Zimmer
MATTER MARCH 24, 2016

Cryptotora thamicola, a waterfall-climbing cave fish that appears to walk the way land vertebrates do, researchers say. Danté Fenolio/Science Source

democratizing taxonomic knowledge



Outreach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Poissons de la Province de l'Ogooué-Lolo
GABON
Cornell University
Museum of Vertebrates
Aimara
The Nature Conservancy
Photos de Brian Sidlauskas et John Sullivan
Montage et mise en page par Kathleen Knight
Membres de l'expédition: Colin Apse, Thibault Cavelier de Cuverville, Joseph Cutler, Yves Fermon, Gervais Koudaou, Jean Hervé Mvé Beh, Marie-Claire Paiz, Brian Sidlauskas et John Sullivan

Thanks!


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Thanks!

Acknowledgments:

Stacey Farina, Kyle Luckenbill, Nathan Lujan, Frank Pezold, Mark Sabaj Pérez, Aurélie Pinton Norma Salcedo, Randy Singer, Brian Sidlauskas, Melanie Stiassny, Tom Vigliotta, Brandon Waltz