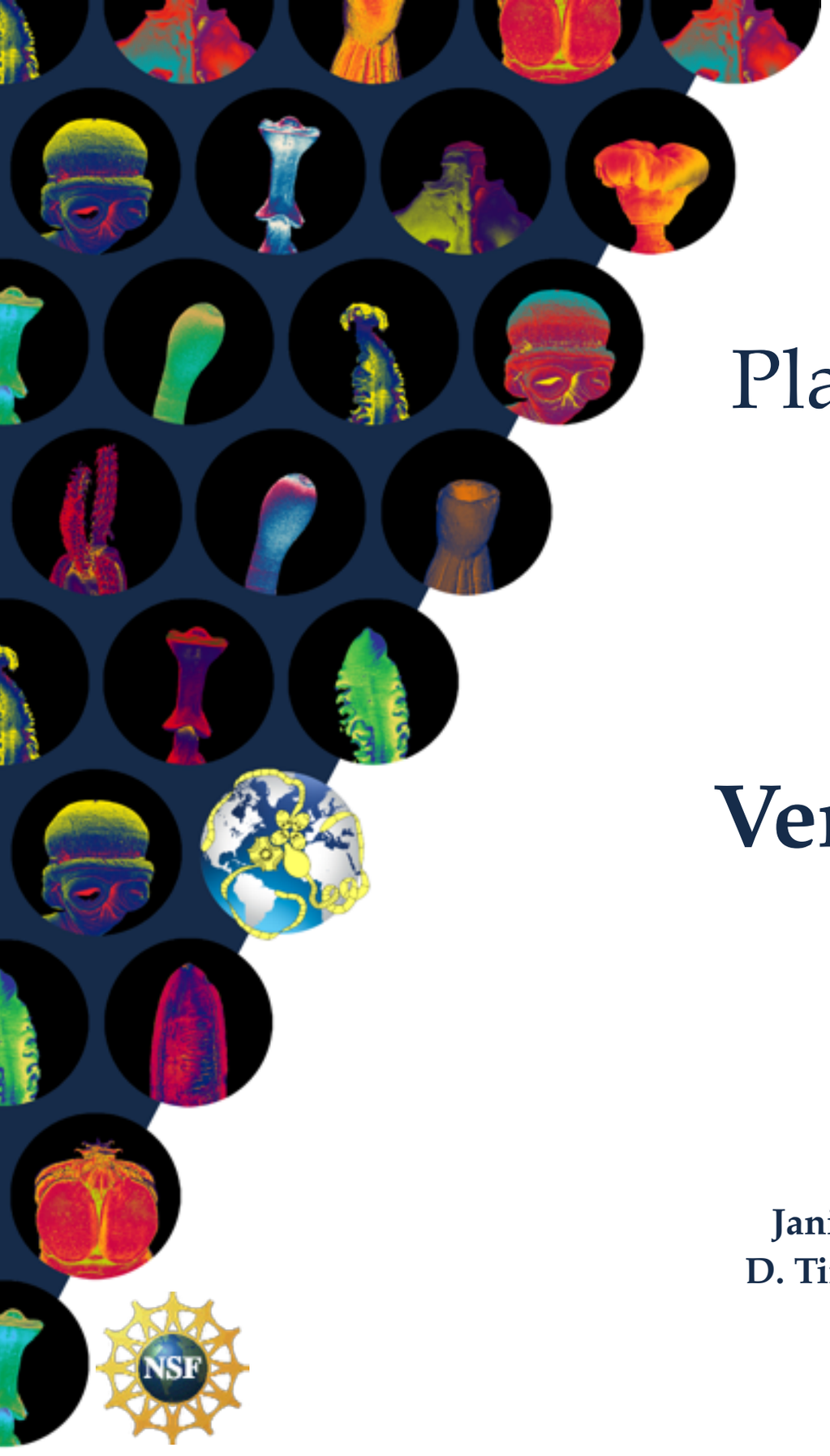


Planetary Biodiversity Inventory
(2008–2017):

Tapeworms from Vertebrate Bowels of the Earth

—AN OVERVIEW—

Janine N. Caira, Kirsten Jensen, Boyko B. Georgiev, Roman Kuchta, D. Timothy J. Littlewood, Jean Mariaux, Tomáš Scholz, Vasyl V. Tkach, and Andrea Waeschenbach

Project Goals

(1) To discover and describe **cestode novelty** from

- as many different countries as possible
- vertebrate groups not previously examined for cestodes

(2) To recollect from historically problematic regions and/or host taxa to resolve major **taxonomic issues**

(3) To **collect specimens** of as many different cestode species across as great a diversity of cestode taxa as possible

(4) To assess **interrelationships** at multiple levels based on phylogenetic analyses of molecular sequence data from multiple genes informed by morphological data

(5) To attempt to reconcile cestode **classification** at all levels with a revised understanding of their phylogenetic relationships

(6) To use historical data and new collections to begin to generate **estimates of total global diversity**

The Team

Bird-hosted cestode team

Jean Mariaux & *Boyko Georgiev*; Eric Hoberg, Vadim Kornyushin, Pavel Nikolov, & Gergana Vasileva

Mammal-hosted cestode team

Vasyl Tkach; Ian Beverage, Voitto Haukisalmi, Vadim Kornyushin

Bony fish-hosted cestode team (+ holocephalans, “herptiles”)

Tomáš Scholz, *Roman Kuchta*, & *Alain de Chambrier*; Alicia Gil de Pertierra, Vladimíra Hanzelová, & Mikulas Oros

Elasmobranch-hosted cestode team

Janine Caira & *Kirsten Jensen*; Ian Beverage, Louis Euzet, Claire Healy, Verónica Ivanov, Masoumeh Malek, Fernando Marques, Lassad Neifar, Harry Palm, Florian Reyda, Tim Ruhnke

Molecular cestode team

Tim Littlewood & *Andrea Waeschenbach*

The Team

Program assistant
Elizabeth Barbeau

Project website and databases
Yi Zhang, Josh Roy, & Jason Card

***Meet the Suckers* children's book**
Virge Kask & Achim Mohrenberg

Training

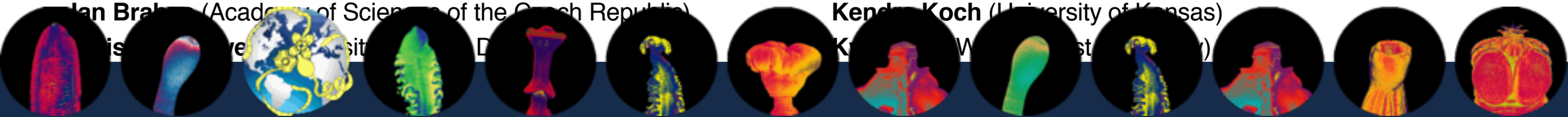
of postdoctoral fellows: **14**
# of graduate students: **35**
# of undergraduate students: **59**

Postdoctoral fellows

Jitka Aldhoun (Natural History Museum in London)
Jan Brabec (Czech Academy of Sciences)
Joanna Cielocha (University of Kansas; Rockhurst University)
Caroline Fyler (University of Connecticut; Martha's Vineyard High School)
Voitto Haukisalmi (Finnish Museum of Natural History)
Miloslav Jirků (Czech Academy of Sciences)
Roman Kuchta (Czech Academy of Sciences)
Arseny Makarikov (Russian Academy of Sciences [Siberian Branch])
Adriana Menoret (Universidad de Buenos Aires)
Maria Pickering (University of Connecticut; Meredith College)
Mikulas Oros (Czech Academy of Sciences; Slovak Academy of Sciences)
Martina Orosová (Slovak Academy of Sciences)
Anna Phillips (University of Connecticut; Smithsonian Institution)
Aneta Yoneva (Bulgarian Academy of Sciences)
Andrea Waeschenbach (Natural History Museum in London)

Graduate students

Philippe Vieira Alves (Univ. Fed. Rural do Rio de Janeiro)
Atabak Aminjan (University of Tehran)
Anirban Ash (Acad. of Sciences of the Czech Republic)
Daniel Barčák (Slovak Academy of Sciences)
James Bernot (University of Connecticut)
Jan Brab (Acad of Scien of the Czech Repub
Mehdi Golestaninasab (University of Tehran)
Stephen Greiman (University of North Dakota)
Rachel Guyer (University of Kansas)
Mohamed Haseli (University of Tehran)
Kaylee Herzog (University of Kansas)
Kend Koch (U ersity of K nsas)



Collaboration!!

Project meetings

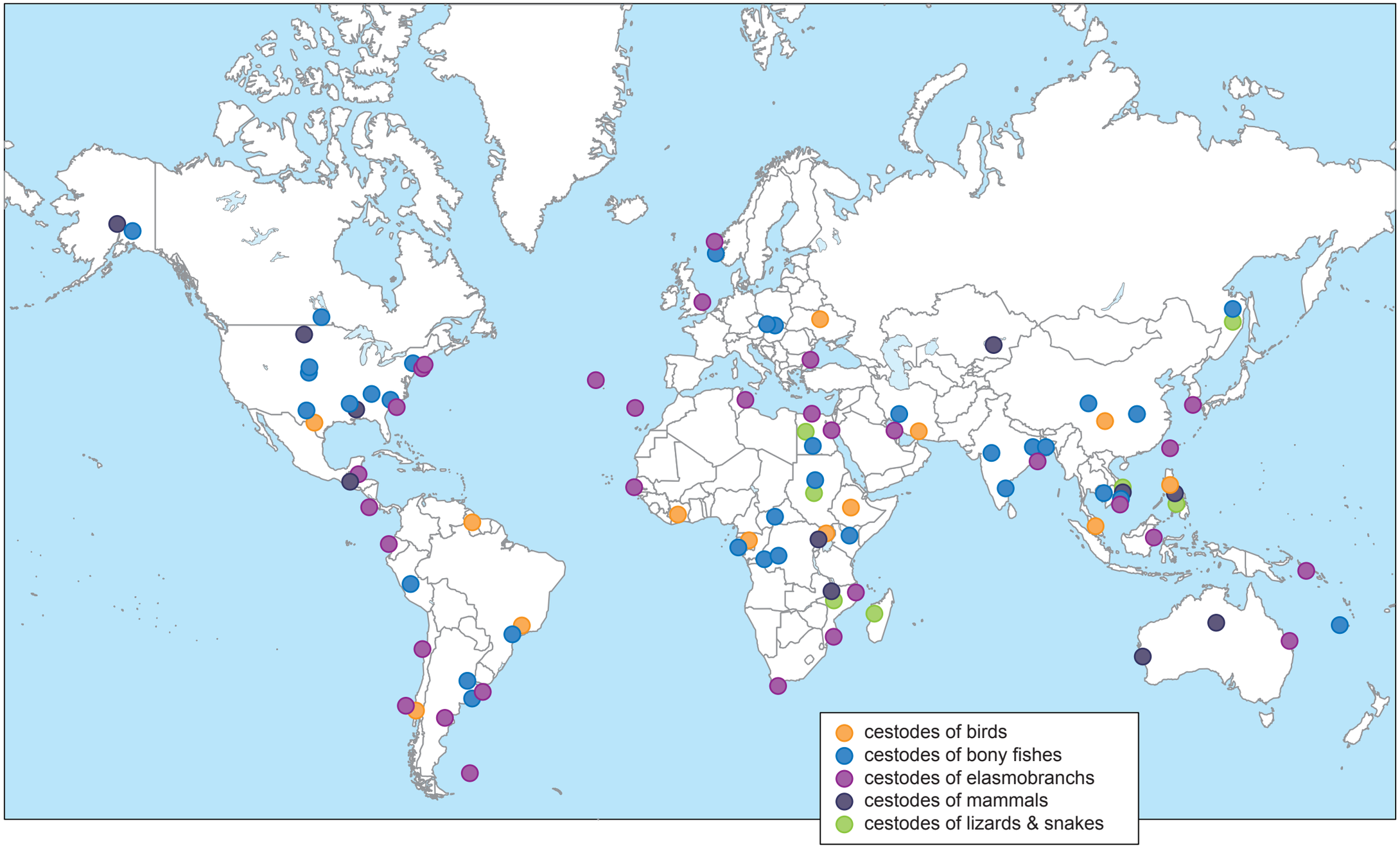
Geneva (2009)
Melbourne (2010) (following XIIth ICOPA)
Lawrence (2011) (following 7th IWCSP)
Geneva (2012)
London (2013)
Brazil (2014) (following 8th IWCSP)

The Team

of participants: **>250**

Fieldwork

countries visited: **54**



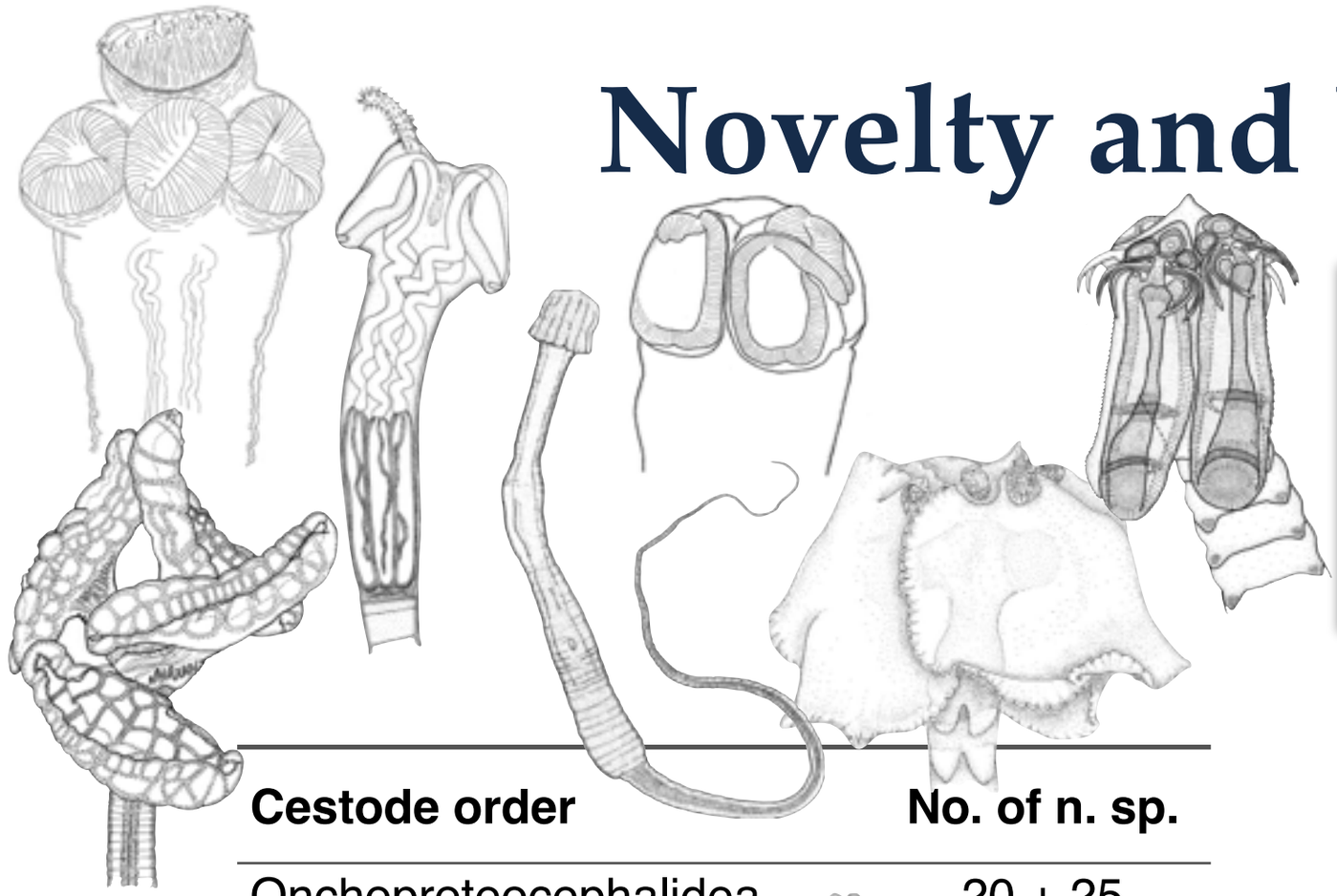
In-country collaborators

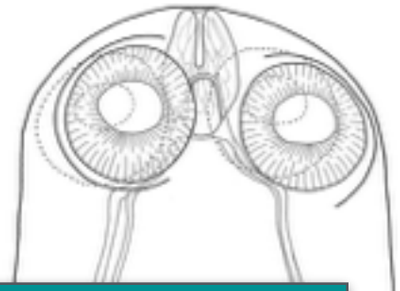
Mostafa Hossain (**Bangladesh**)
Norlan Lamb & Roy Polonio (**Belize**)
Natalia Da Mata Luchetti, Fernando P. L. Marques, Luis Eduardo Tavares, Marcos Tavares, José Luque, & Ricardo Takemoto (**Brazil**)
Pavel Nikolov (**Bulgaria**)
Touch Bunthang (**Cambodia**)
Manigandan Lejeune Virapin (**Canada**)
Francisco Concha, Günther Försterra, Daniel González-Acuña, & Vreni Häussermann (**Chile**)
Dian Gao, Cai Kuizheng, Pin Nie, Gui Tang Wang, Shan Gong Wu, & Bing Wen Xi (**China**)
Tayler Clarke, Ingo Wehrtmann, & Mario Espinoza (**Costa Rica**)
Oscar Carreno & Gabriela Flores (**Ecuador**)
Mohamed Bosseri & Amal Khalil (**Egypt**)
Eshete Dejen Dresilign, Abebe Getuhun Gubale, & Seyoum Mengistou (**Ethiopia**)
Joost Pompert (**Falkland Islands**)
Bernard Marchand (**France**)
Mathieu Bourgarel & Jean-Paul Gonzales (**Gabon**)
Anirban Ash & Pradip K. Kar (**India**)
Asri Yuinar (**Indonesia**)
Razieh Ghayoumi & Masoumeh Malek (**Iran**)
Andrea Gustinelli (**Italy**)
Inza Kone (**Ivory Coast**)
Steven Goodman, Marie Jeanne Raherilalao, Jeanne Rasamy, & Achille Raselimanana (**Madagascar**)
R. Hashim, Susan Lim (late), & R. Ramli (**Malaysia**)
Samuel Bila (**Mozambique**)
Jean-Lou Justine (**New Caledonia**)
Martin Mortenthaler, Aurora Ramírez Aricara, & Lidia Sánchez (**Peru**)
Rafe Brown (**Philippines**)
Graca Costa & Gui Menezes (**Portugal**)
Vladimir Besprovaznnykh, Vladimir Chistyakov, & Alexey Ermolenko (**Russia**)
Rokhaya Sall (**Senegal**)
David Blair, Tingo Leve, & Richard Mounsey (**Solomon Islands**)
Tracey Fairweather & Robert Leslie (**South Africa**)
Ki Hong Kim (**South Korea**)
Zuheir Mahmoud (**Sudan**)
Hsuan-Ching Ho & Hsuan-Wien Chen (**Taiwan**)
Lawan Chanhome (**Thailand**)
Jim Ellis & Andrew Shinn (**UK**)
Olga Lisitsyna & Yuriy Kvach (**Ukraine**)
Michael Barger, Megan Bean, Sara Brant, Isaure de Buron, Anindo Choudhury, Joseph Cook, Stephen Curran, Bryan Frazier, Andrew Hope, David G. Huffman, John M. Kinsella, Robin Overstreet, Eric Pulis, & Jason Weckstein (**USA**)
Tran T. Binh & Vu Quang Manh (**Vietnam**)

Novelty and Diversity

of new species: **215**
# of new genera: **64**
# of new combinations: **135**
# of species synonymized: **~200**

Novelty and Diversity

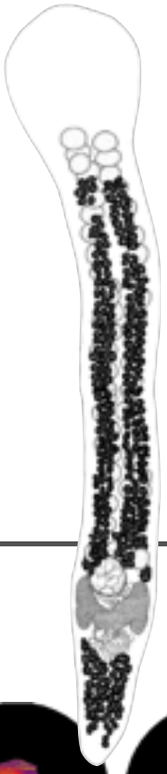




# of new species: **215**
# of new genera: **64**
# of new combinations: **135**
# of species synonymized: **~200**

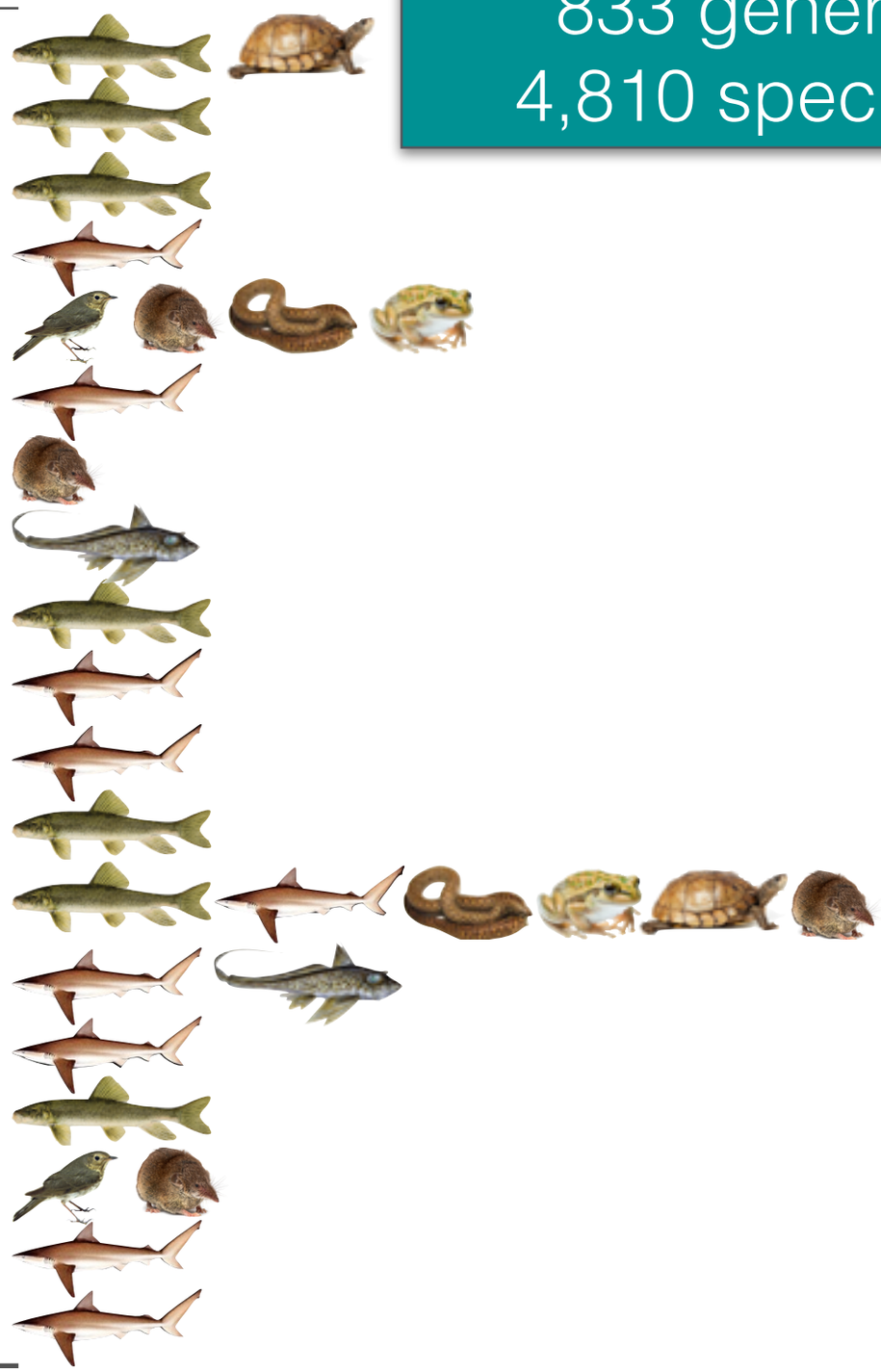
Cestode order	No. of n. sp.
Onchoproteocephalidea	20 + 25
Cyclophyllidea	36
Lecanicephalidea	31
Trypanorhyncha	31
Rhinebothriidea	25
Diphyllidea	18
“Tetraphyllidea” relics	10
Phyllobothriidea	8
Caryophyllidea	6
Bothriocephalidea	3
Litobothriidea	1
Tetrabothriidea	1

Cestode order	No. of n. gen.
Cyclophyllidea	20
Lecanicephalidea	9
Onchoproteocephalidea	8 + 1
Trypanorhyncha	8
Bothriocephalidea	5
Rhinebothriidea	5
Diphyllidea	4
Phyllobothriidea	2
Caryophyllidea	1
“Tetraphyllidea” relics	1



Diversity

Cestode order	No. of valid genera	No. of valid species
Amphilinidea	6	8
Bothriocephalidea	48	132
Caryophyllidea	42	122
Cathetocephalidea	3	6
Cyclophyllidea	437	3,034
Diphyllidea	6	59
Diphyllobothriidea	18	70
Gyrocotylidea	1	10
Haplobothriidea	1	2
Lecanicephalidea	29	90
Litobothriidea	1	9
Nippotaeniidea	1	6
Onchoproteocephalidea	79	562
Phyllobothriidea	24	69
Rhinebothriidea	22	136
Spathebothriidea	5	6
Tetrabothriidea	6	70
“Tetraphyllidea” relics	25	104
Trypanorhyncha	81	315



CURRENT STATUS:
833 genera
4,810 species

Diversity

Cestode order	No. gen
Amphilinidea	
Bothriocephalidea	
Caryophyllidea	
Cathetocephalidea	
Cyclophyllidea	
Diphyllidea	
Diphyllobothriidea	
Gyrocotylidea	
Haplobothriidea	
Lecanicephalidea	
Litobothriidea	
Nippotaeniidea	
Onchoproteocephalidea	
Phyllobothriidea	
Rhinebothriidea	
Spathebothriidea	
Tetrabothriidea	6
“Tetraphyllidea” relics	25
Trypanorhyncha	81

Cyclophyllidean family	No. of valid genera	No. of valid species
Acoleidae	2	5
Amabiliidae	10	32
Anoplocephalidae	81	480
Catenotaeniidae	6	36
Davaineidae	37	450
Dilepididae	90	750
Dioicocestidae	5	21
Dipylidiidae	3	15
Gryporhynchidae	16	76
Hymenolepididae	130	923
Mesocestoididae	2	13
Metadilepididae	10	15
Nematotaeniidae	5	19
Paruterinidae	24	125
Progynotaeniidae	6	24
Taeniidae	4	50

Onchoprotecephalidea (by host group)	No. of valid genera	No. of valid species
I: non-elasmobranch	68	316
II: elasmobranch	11	246

ENT STATUS:
33 genera
10 species

Host Associations

Vertebrate diversity

32,855 spp.

10,104 spp.

7,621 spp.

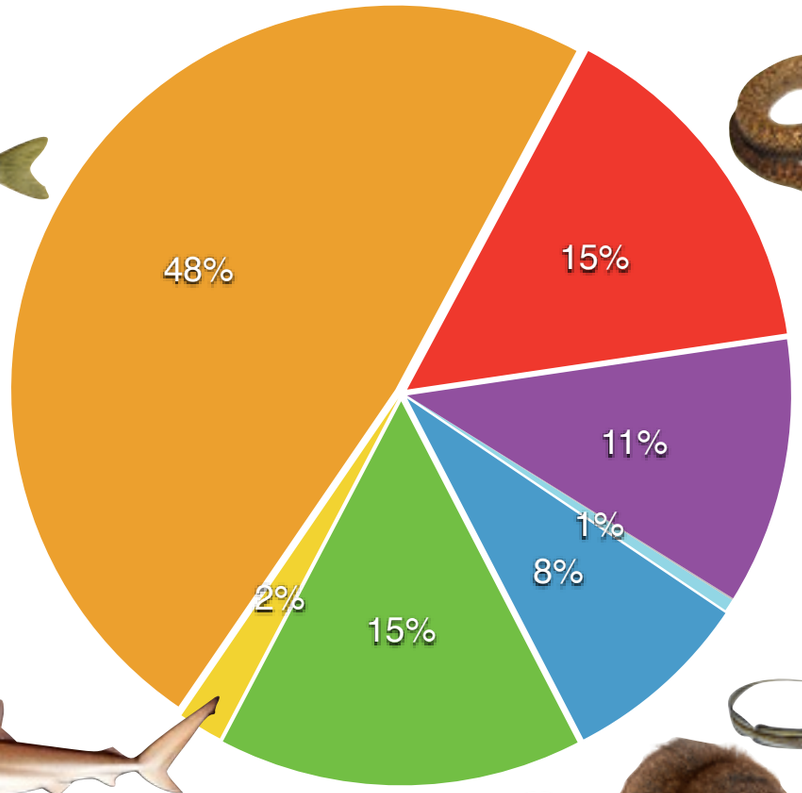
346 spp.

1,269 spp.

10,404 spp.

5,416 spp.

52 spp.



- Birds
- Mammals
- Elasmobranchs
- Bony fishes
- Snakes & lizards
- Amphibians
- Holocephalans
- Turtles

Host Associations

Vertebrate diversity

Amphilinidea
Bothriocephalidea
Caryophyllidea
Haplobothriidea
Nippotaeniidea
Onchoproteocephalidea
Spathebothriidea

Cyclophyllidea
Anoplocephalidae
Nematotaeniidae
Onchoproteocephalidea

Cyclophyllidea
Nematotaeniidae
Onchoproteocephalidea

Amphilinidea
(Onchoproteocephalidea)

Cathetocephalidea
Diphyllidea
Lecanicephalidea
Litobothriidea
Onchoproteocephalidea
Phyllobothriidea
Rhinebothriidea
“Tetraphyllidea” relics
Trypanorhyncha

Gyrocotylidea
(Phyllobothriidea)

Cyclophyllidea
Acoleidae
Amabiliidae
Anoplocephalidae
Davaineidae
Dilepididae
Dioicocestidae
Gryporhynchidae
Hymenolepididae
Mesocestoididae
Metadilepididae
Paruterinidae
Progynotaeniidae
Tetrabothriidea

Cyclophyllidea
Anoplocephalidae
Catenotaeniidae
Davaineidae
Dilepididae
Dipylidiidae
Hymenolepididae
Mesocestodidiae
(Paruterinidae)
Taeniidae
Diphyllobothriidea
(Onchoproteocephalidea)
Tetrabothriidea

48%

15%

11%

1%

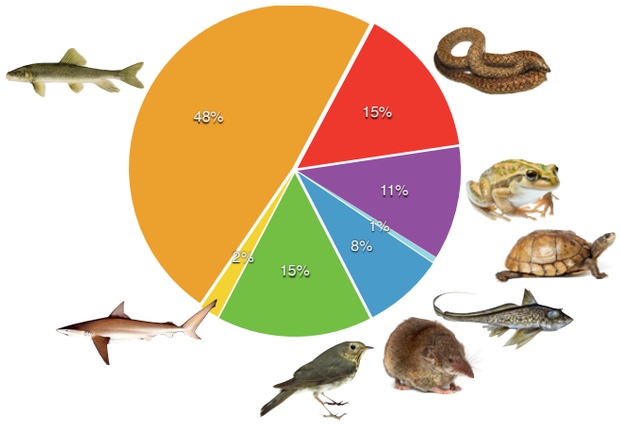
8%

2%

15%

- Birds
- Mammals
- Elasmobranchs
- Bony fishes
- Snakes & lizards
- Amphibians
- Holocephalans
- Turtles

Host Associations



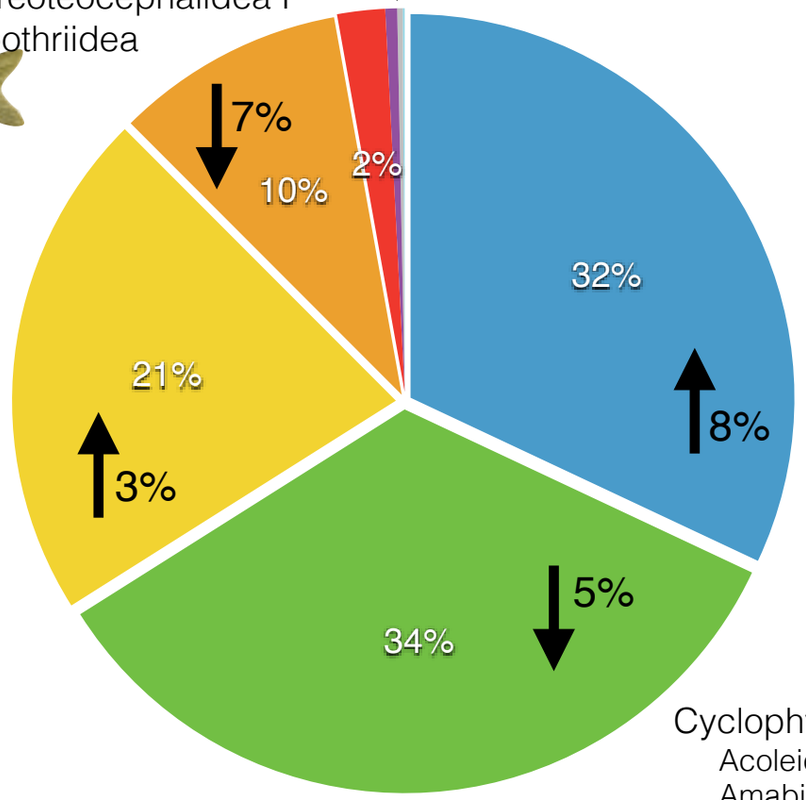
Amphilinidea
Bothriocephalidea
Caryophyllidea
Haplobothriidea
Nippotaeniidea
Onchopreoteocephalidea I
Spathebothriidea

Cyclophyllidea
Anoplocephalidae
Nematotaeniidae
Onchoproteocephalidea I

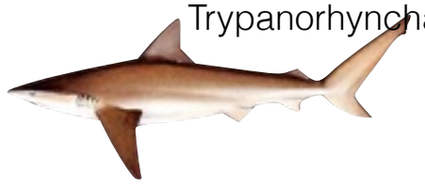
Cyclophyllidea
Nematotaeniidae
Onchoproteocephalidea I

Gyrocotylidea
(Phyllobothriidea)

Amphilinidea
(Onchoproteocephalidea I)



Cathetocephalidea
Diphyllidea
Lecanicephalidea
Litobothriidea
Onchoproteocephalidea II
Phyllobothriidea
Rhinebothriidea
“Tetraphyllidea” relics
Trypanorhyncha



Cyclophyllidea
Anoplocephalidae
Catenotaeniidae
Davaineidae
Dilepididae
Dipylidiidae
Hymenolepididae
Mesocestodidiae
(Paruterinidae)
Taeniidae

Diphyllobothriidea
(Onchoproteocephalidea I)
Tetrabothriidea

Cyclophyllidea
Acoleidae
Amabiliidae
Anoplocephalidae
Davaineidae
Dilepididae
Dioicocestidae
Gryporhynchidae
Hymenolepididae
Mesocestoididiae
Metadilepididae
Paruterinidae
Progynotaeniidae
Tetrabothriidea

CURRENT STATUS:
4,810 species

Relative cestode diversity (species) by vertebrate class

- Hosted by birds
- Hosted by mammals
- Hosted by elasmobranchs
- Hosted by bony fishes
- Hosted by snakes & lizards
- Hosted by amphibians
- Hosted by holocephalans
- Hosted by turtles

Host Associations—Poor hosts

Vertebrate groups hosting few or no tapeworms:


Squamata (snakes and lizards)


Chelonii (turtles)


Amphibia (frogs and salamanders)

Artiodactyla (deer, etc.)

Perissodactyla (horses, etc.)

Primata (monkeys, etc.)


Procellariformes (petrels, etc.)

Sphenisciformes (penguins)


Squaliformes (dogfish, etc.)

“Scyliorhinidae” (cat sharks)

Scombridae (mackerels, tunas, etc.)

Host Associations—Good hosts

Vertebrate groups especially good hosts for tapeworms:

Soricomorpha (shrews, etc.)

Chiroptera (bats)

Lagomorpha (rabbits, etc.)

Carnivora (bears, etc.)

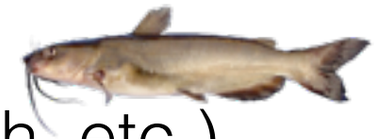
Marsupialia (kangaroos, etc.)

Passeriformes (sparrows, etc.)

Charadriiformes (plovers, seagulls, etc.)

Podicipediformes (grebes)

Anseriformes (ducks, geese, etc.)

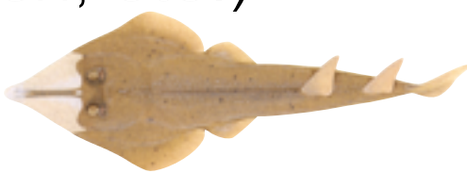


Siluriformes (catfish, etc.)

Cypriniformes (carp, etc.)

Myliobatiformes (stingrays, etc.)

Rhinopristiformes (guitarfish, etc.)



Host Associations—New records

Bothriocephalidea

Bothriocephalus sp. from order Lepisosteiformes

New host family records: Archiridae, Bovichtidae, Platycephalidae, & Serranidae

Diphyllidea

New host family records: Gurgesiellidae & Proscylliidae

Lecanicephalidea

New host family records: Zanobatidae & Urolophidae; + freshwater

Onchoproteocephalidea I

New host family records: Gekkonidae and Dactyloidae; Pangasiidae

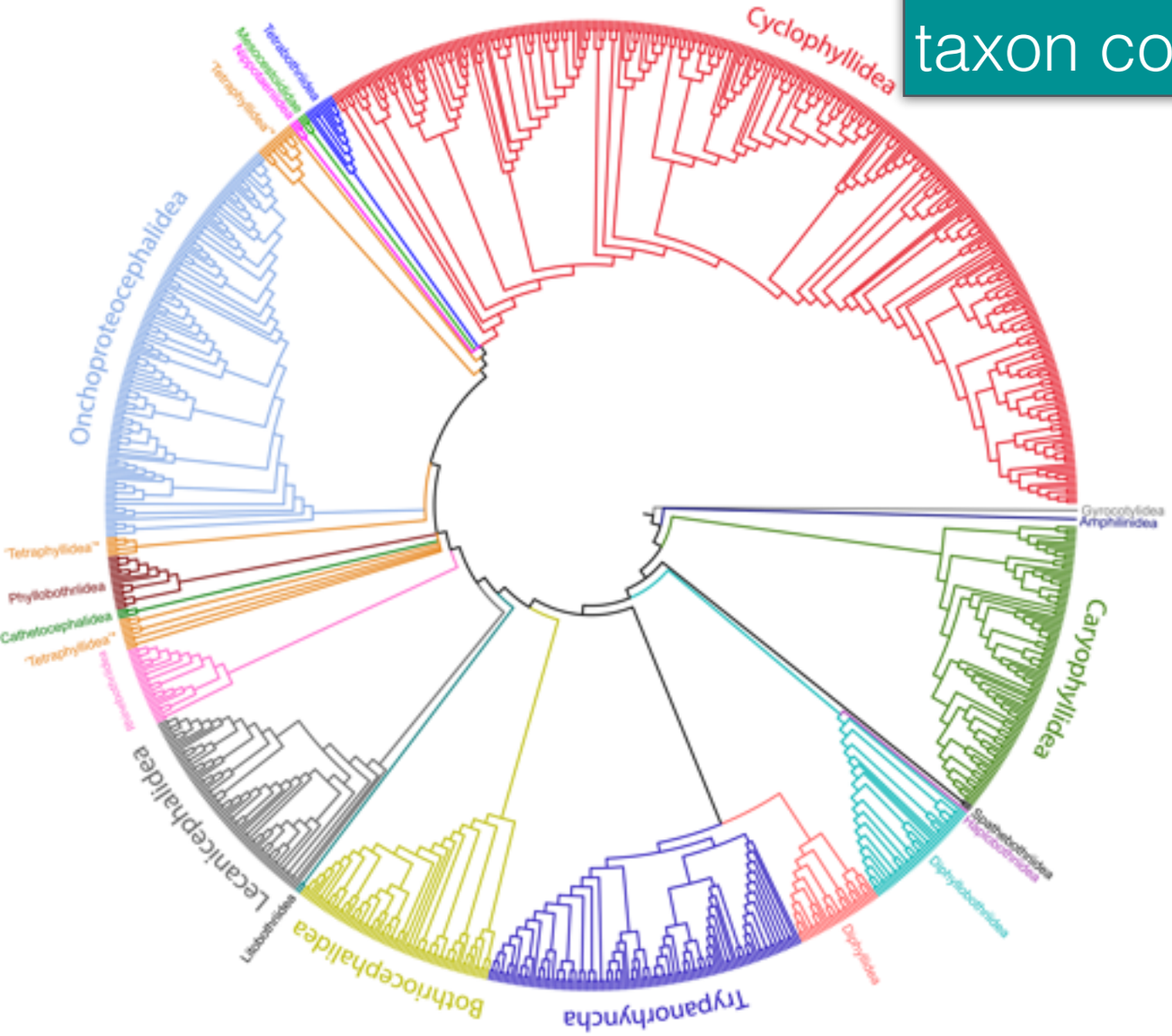
New genus from Australian endemic frog

Rhinebothriidea

New host family records: Platyrhinidae

Phylogenetics and Classification

of specimens sequenced: **~1,000**
# of orders sequenced: **15/19**
loci: **28S rDNA, 18S rDNA, COI, 16S rDNA**
taxon coverage (by order): **10–80%**



Bothriocephalidea	44%
Caryophyllidea	80%
Cathetocephalidea	75%
Cyclophyllidea (incl. Mesoc.)	10%
Diphyllidea	52%
Diphyllobothriidea	36%
Lecanicephalidea	26%
Litobothriidea	55%
Nippotaeniidea	57%
Onchoproteocephalidea	35%/12%
Phyllobothriidea	29%
Rhinebothriidea	37%
Tetrabothriidea	(few)
“Tetraphyllidea” relics	33%
Trypanorhyncha	33%

Phylogenetics

Novel phylogenetic frameworks:

Bothriocephalidea

Caryophyllidea

Cyclophyllidea

Diphyllidea

Diphyllobothriidea

Lecanicephalidea

Litobothriidea

Onchoproteocephalidea

Phyllobothriidea

Rhinebothriidea

“Tetraphyllidea” relics

Trypanorhyncha

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Phylogenetics and Classification

Author's personal copy

Molecular Phylogenetics and Evolution 63 (2012) 834–847

Contents lists available at SciVerse ScienceDirect

Molecular Phylogenetics and Evolution

journal homepage: www.elsevier.com/locate/ympev

Adding resolution to ordinal level relationships of tapeworms (Platyhelminthes: Cestoda) with large fragments of mtDNA

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ABSTRACT

The construction of a stable phylogeny for the Cestoda, indicating the interrelationships of recognised orders and other major lineages, has proceeded iteratively since the group first received attention from phylogenetic systematists. Molecular analyses using nuclear ribosomal RNA gene fragments from the

International Journal for Parasitology 44 (2014) 55–73

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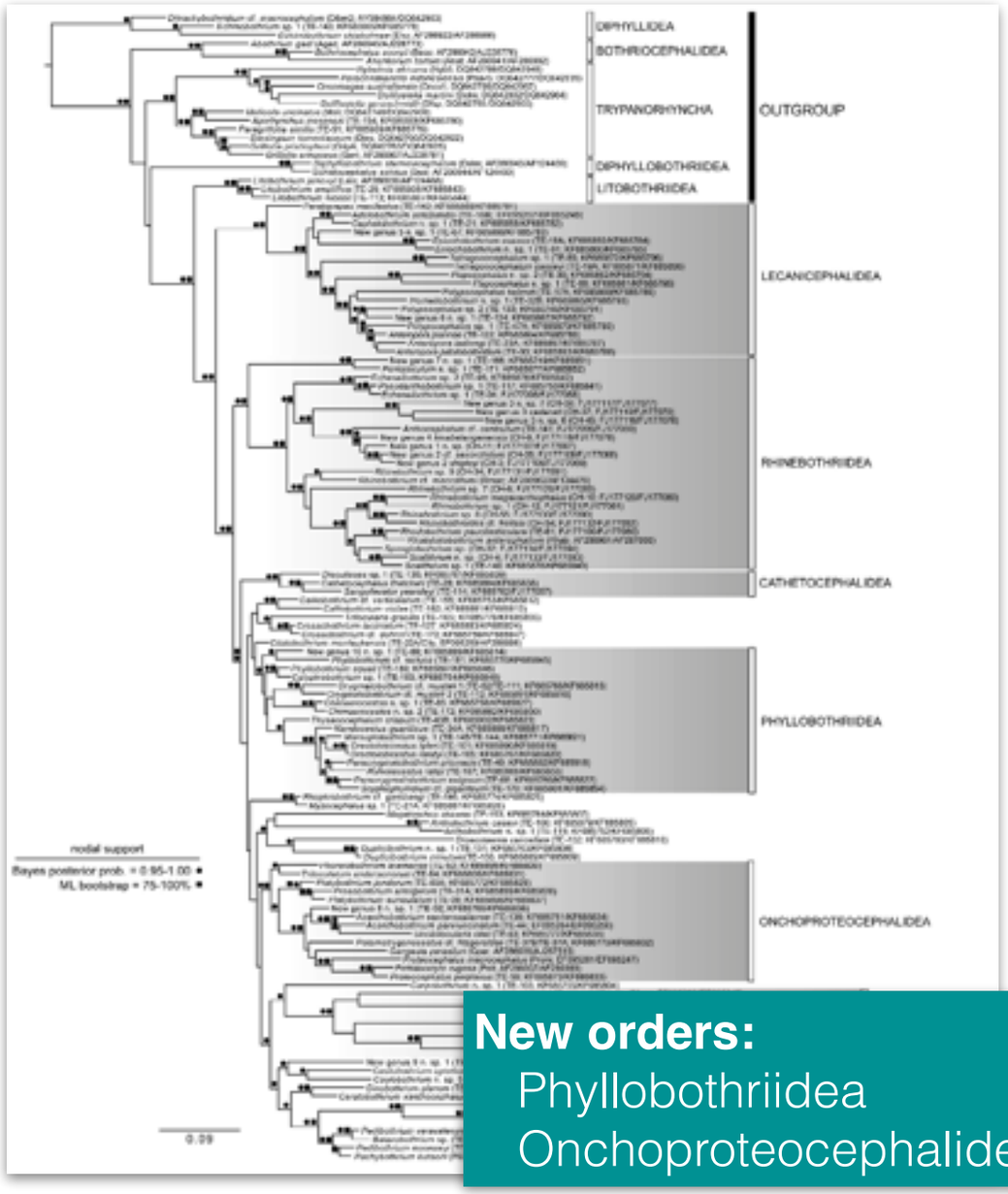
International Journal for Parasitology

journal homepage: www.elsevier.com/locate/ijpara



New orders:
Phyllobothriidea
Onchoproteocephalidea

Classification

Trypanorhyncha

Rhinebothriidea

Lecanicephalidea

Onchopreoteocephalidea

New suborders:

Trypanobatoidea

Trypanoselaoidea

New family-level classification

New families:

Anthocephaliidae

Escherbothriidae

New family-level classification

New families:

Aberrapecidae

Eniochobothriidae

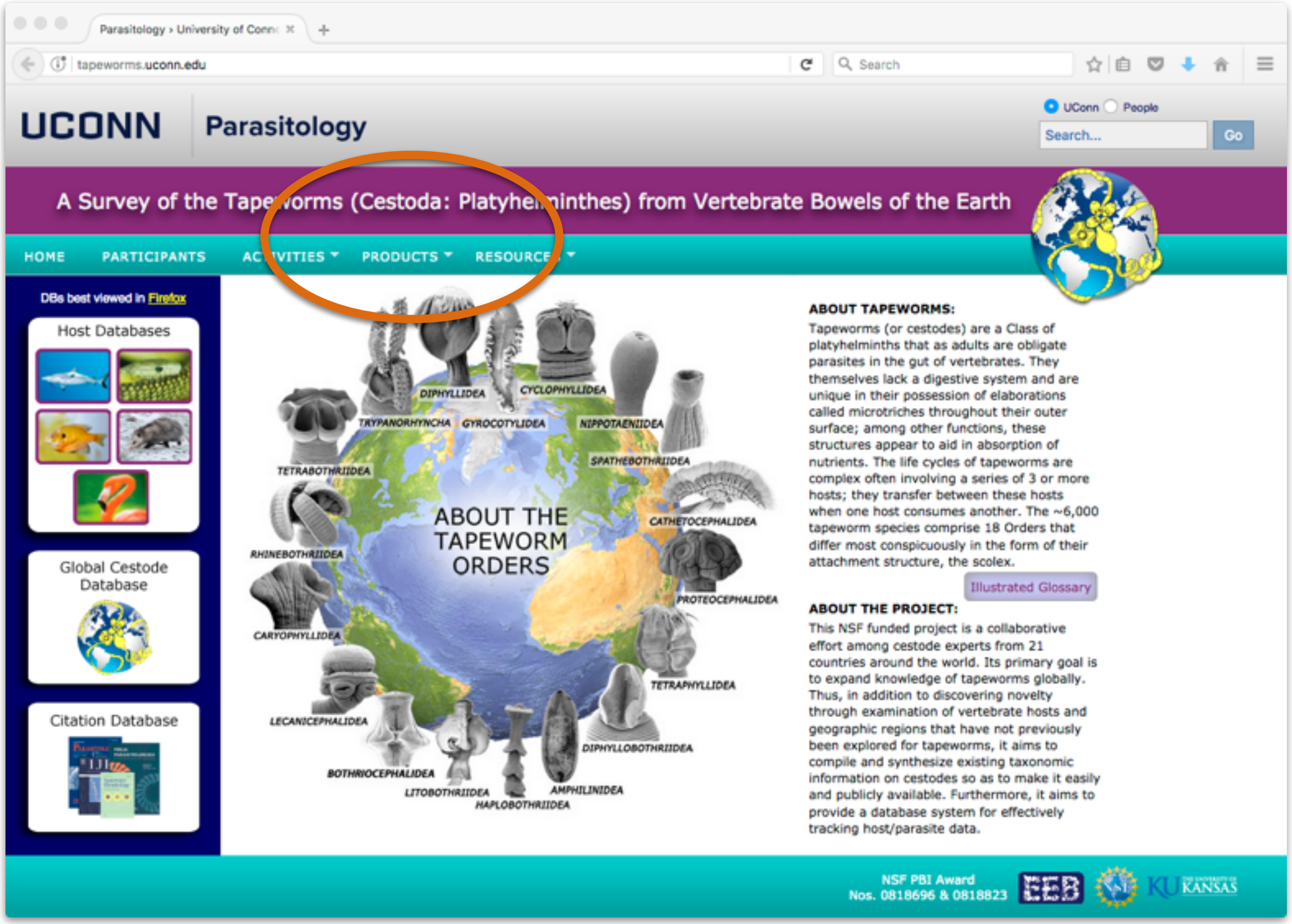
Paraberrapecidae

Zanobatocestidae

New subfamily:

Testudotaeniinae

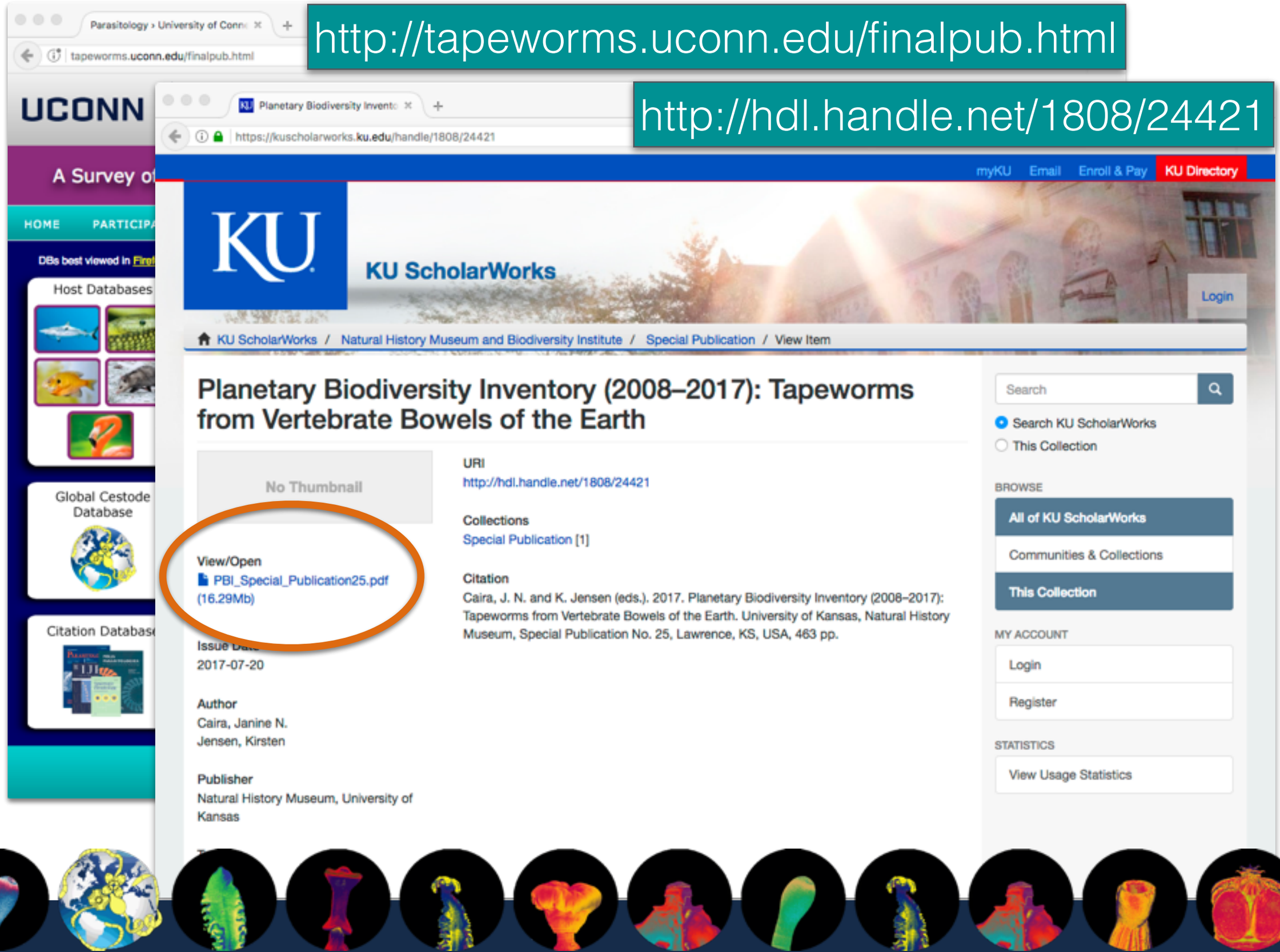
Dissemination



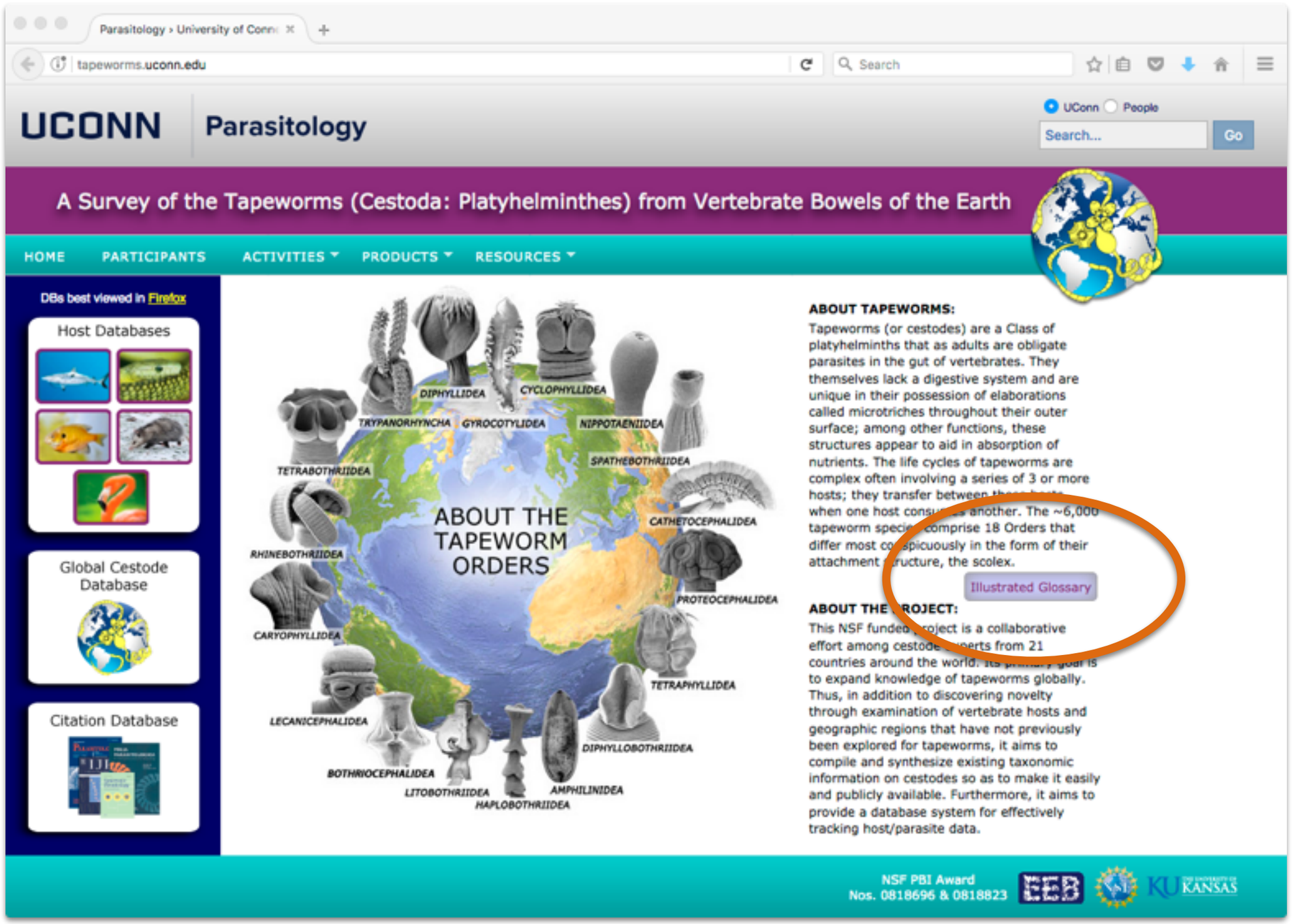
Dissemination

http://tapeworms.uconn.edu/finalpub.html

http://hdl.handle.net/1808/24421



Dissemination



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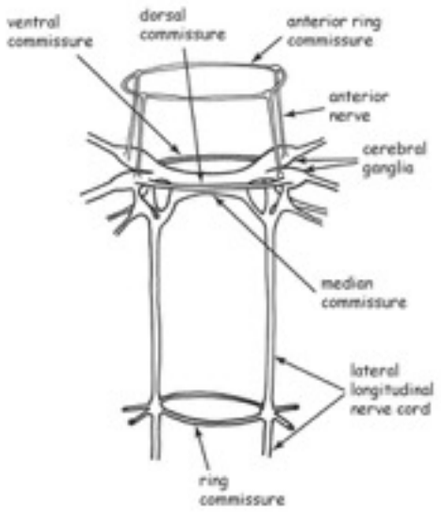
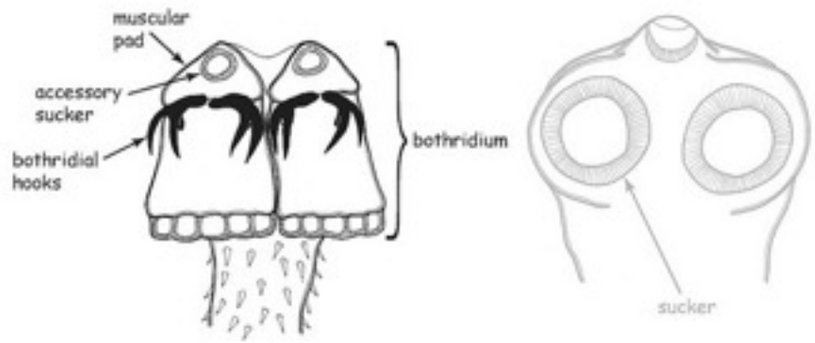
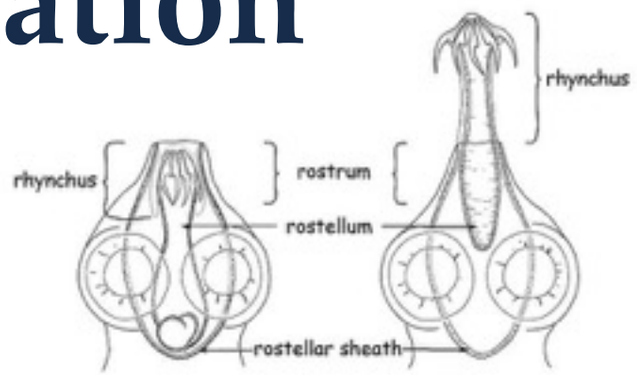
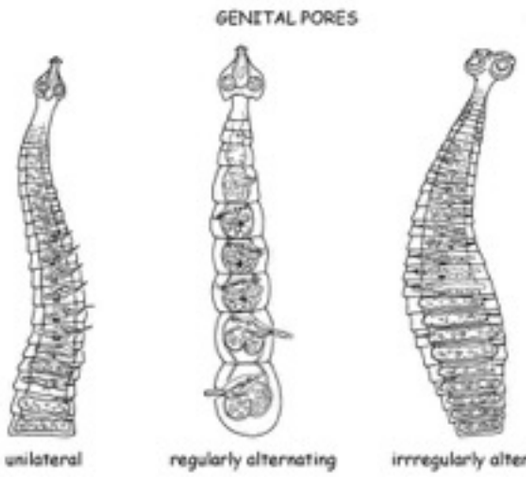


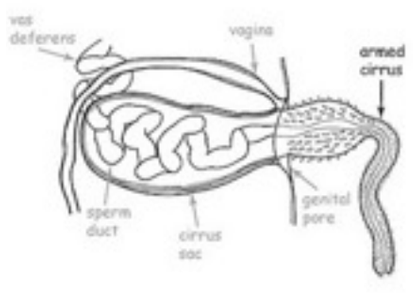


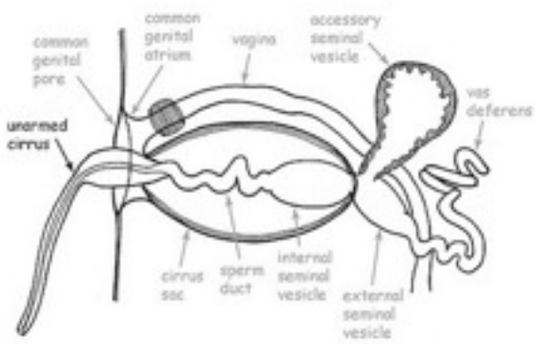


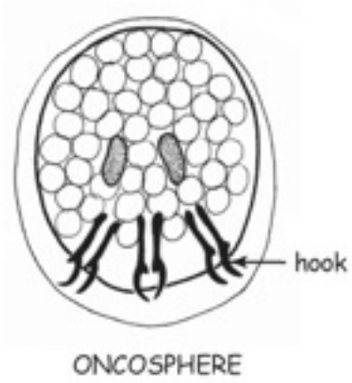
SCOLEX W
RETRACTILE ROSTEL

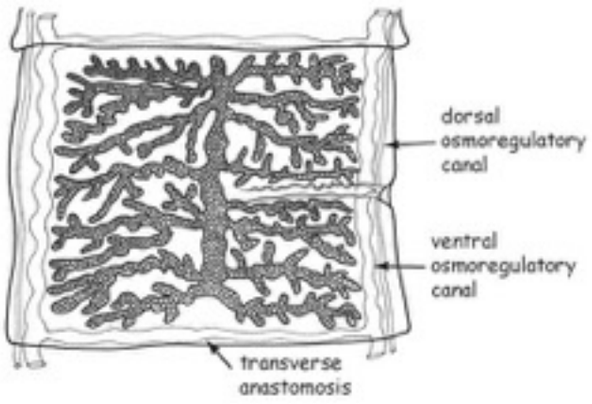
Illustrated Glossary

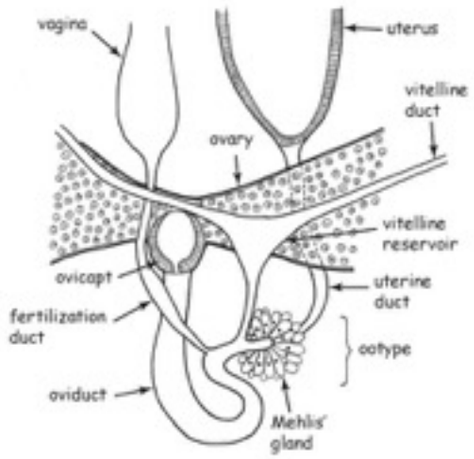


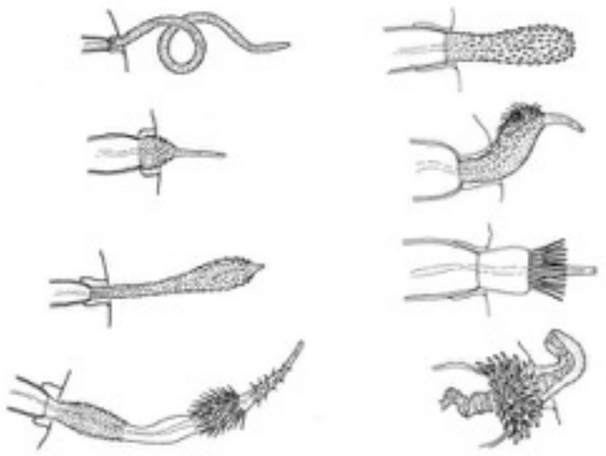








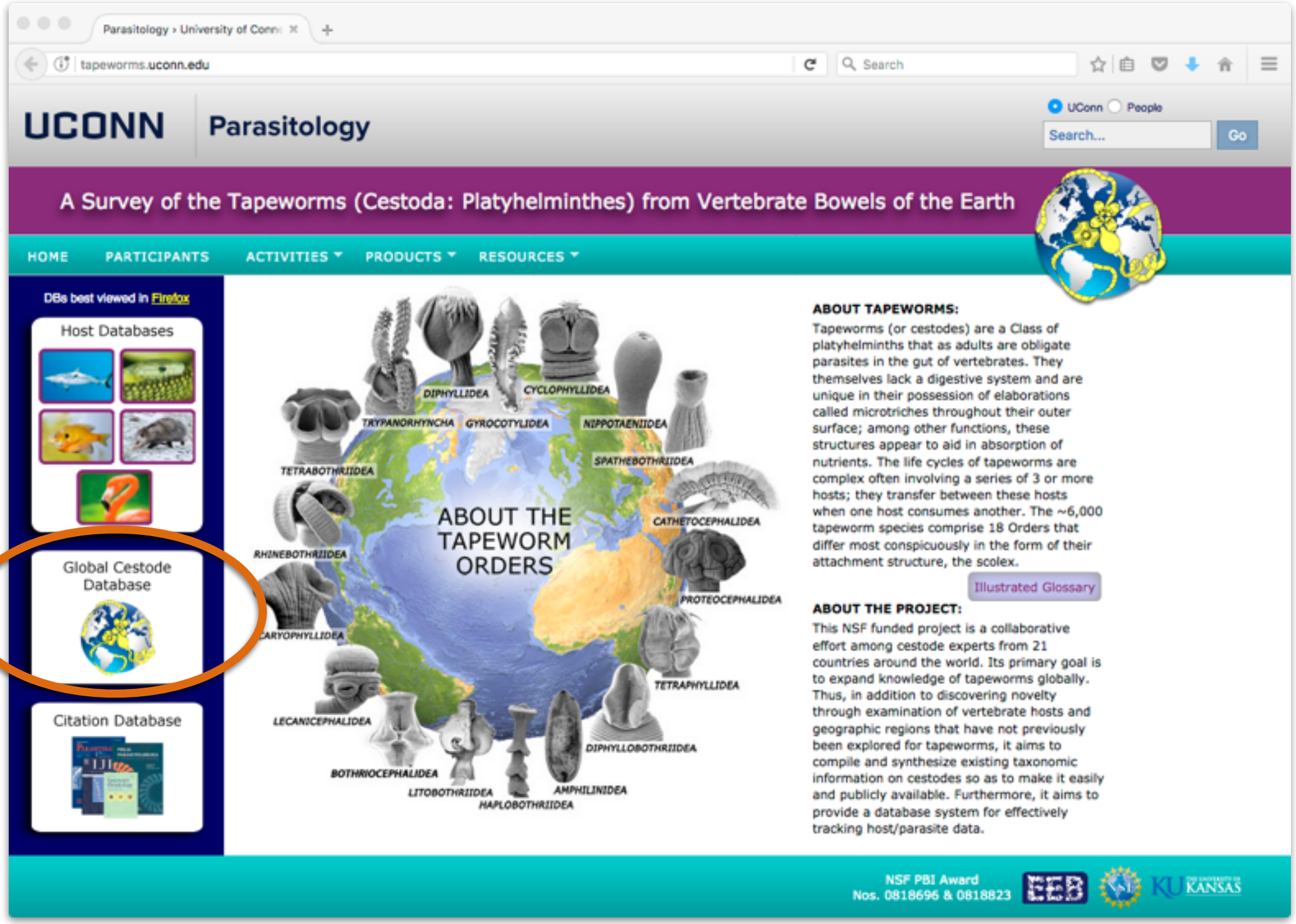




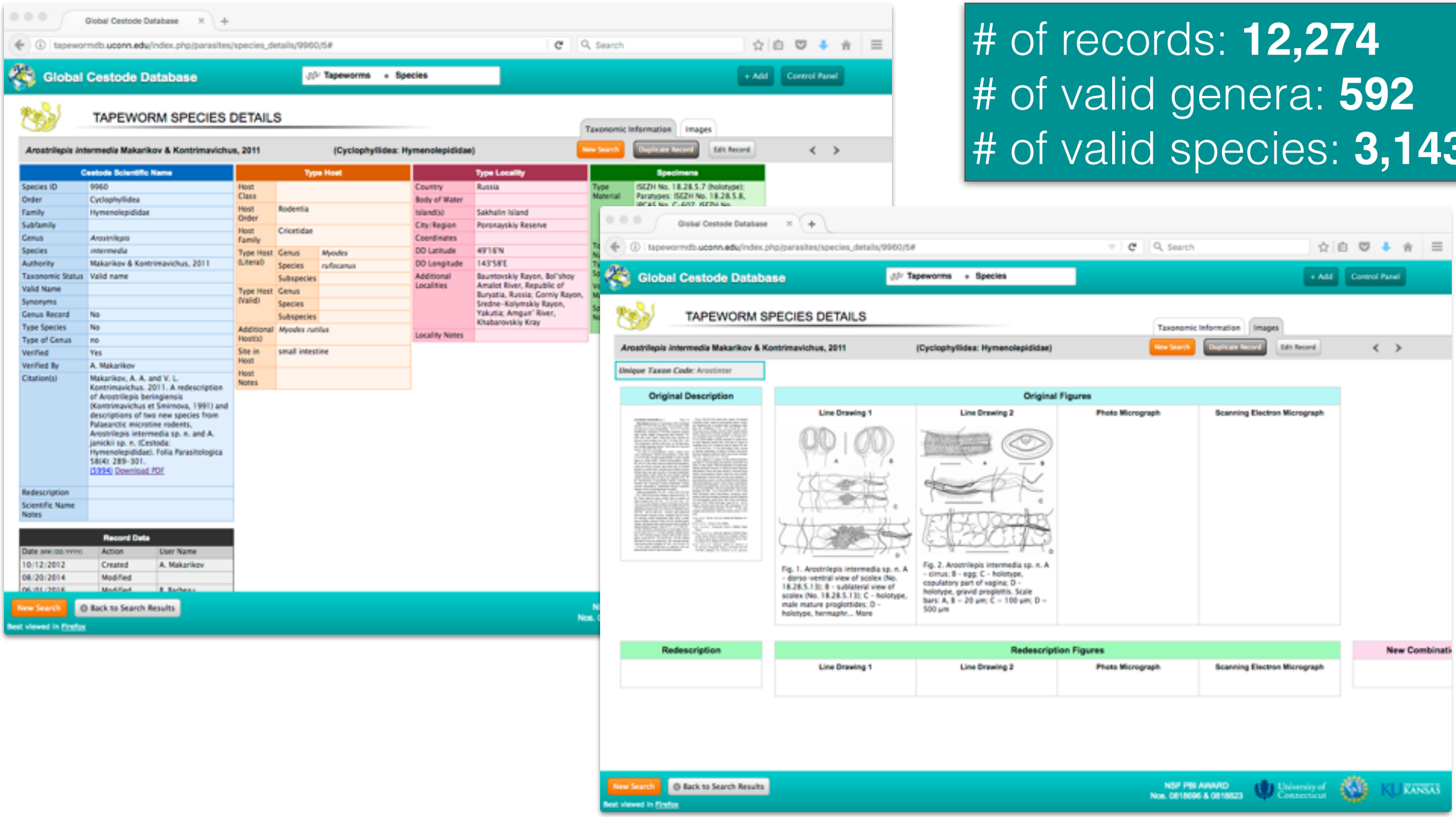
EVAGINATED CIRRUS

LIST OF ILLUSTRATIONS

Dissemination

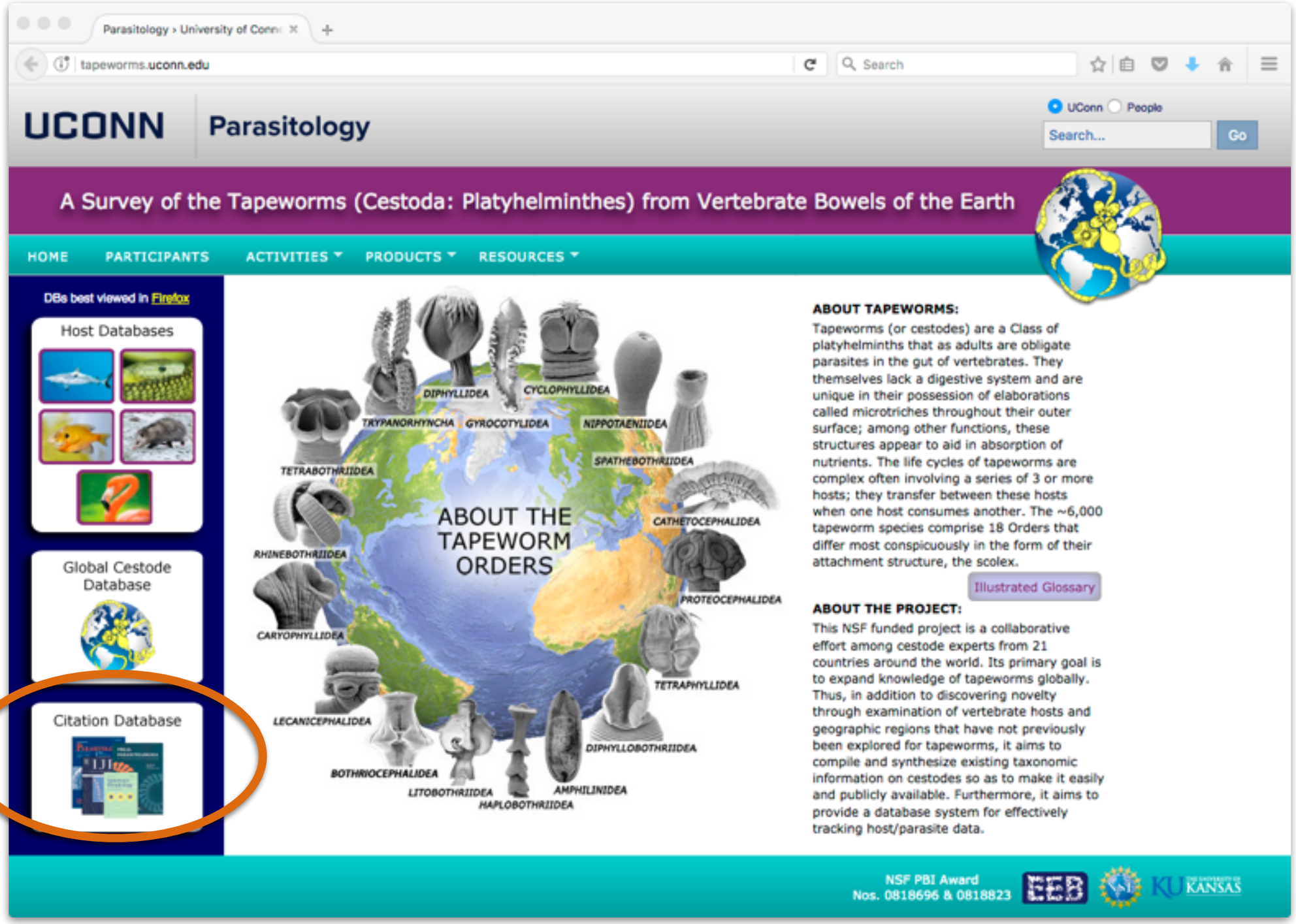


Global Cestode Database



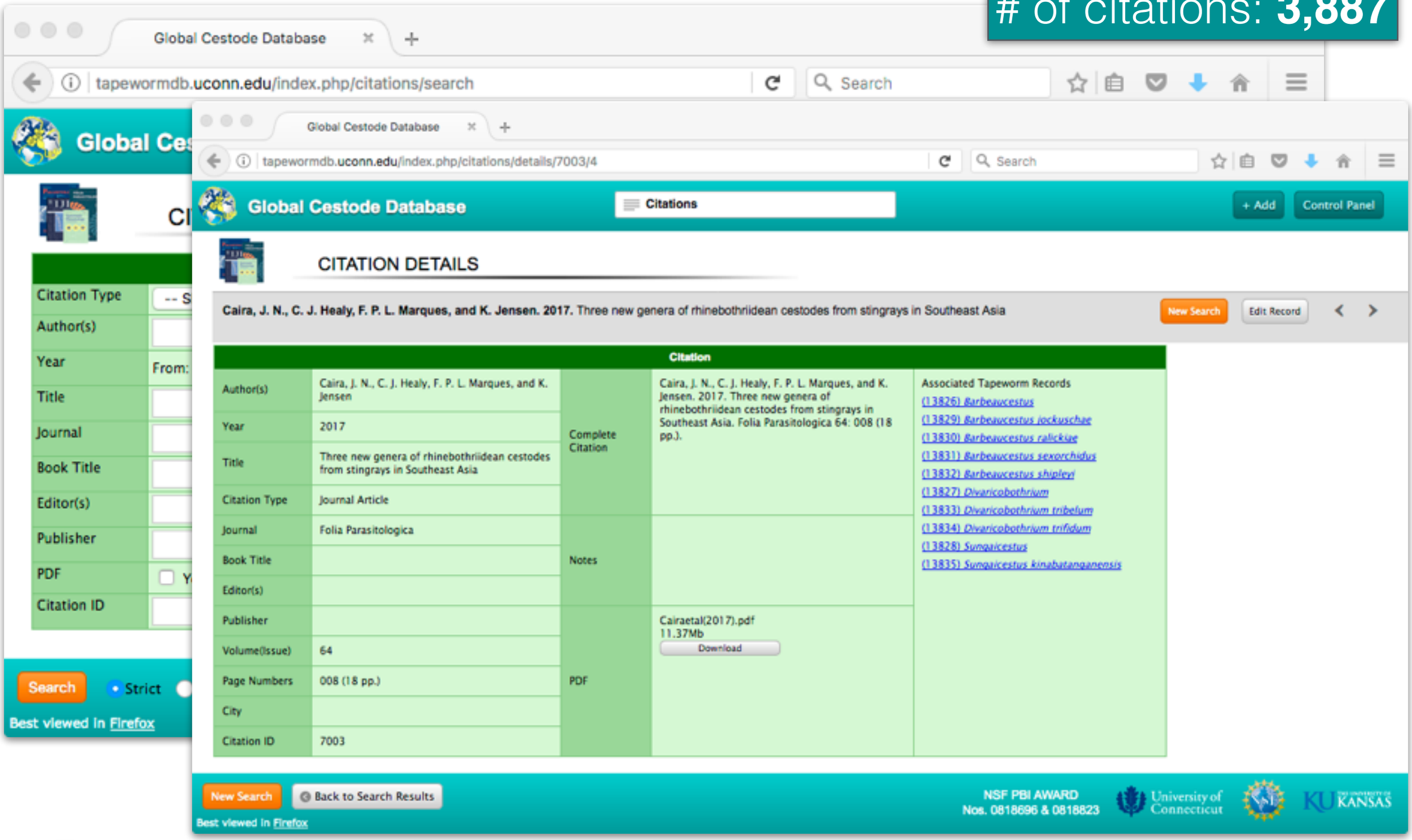
# of records: **12,274**
# of valid genera: **592**
# of valid species: **3,143**

Dissemination

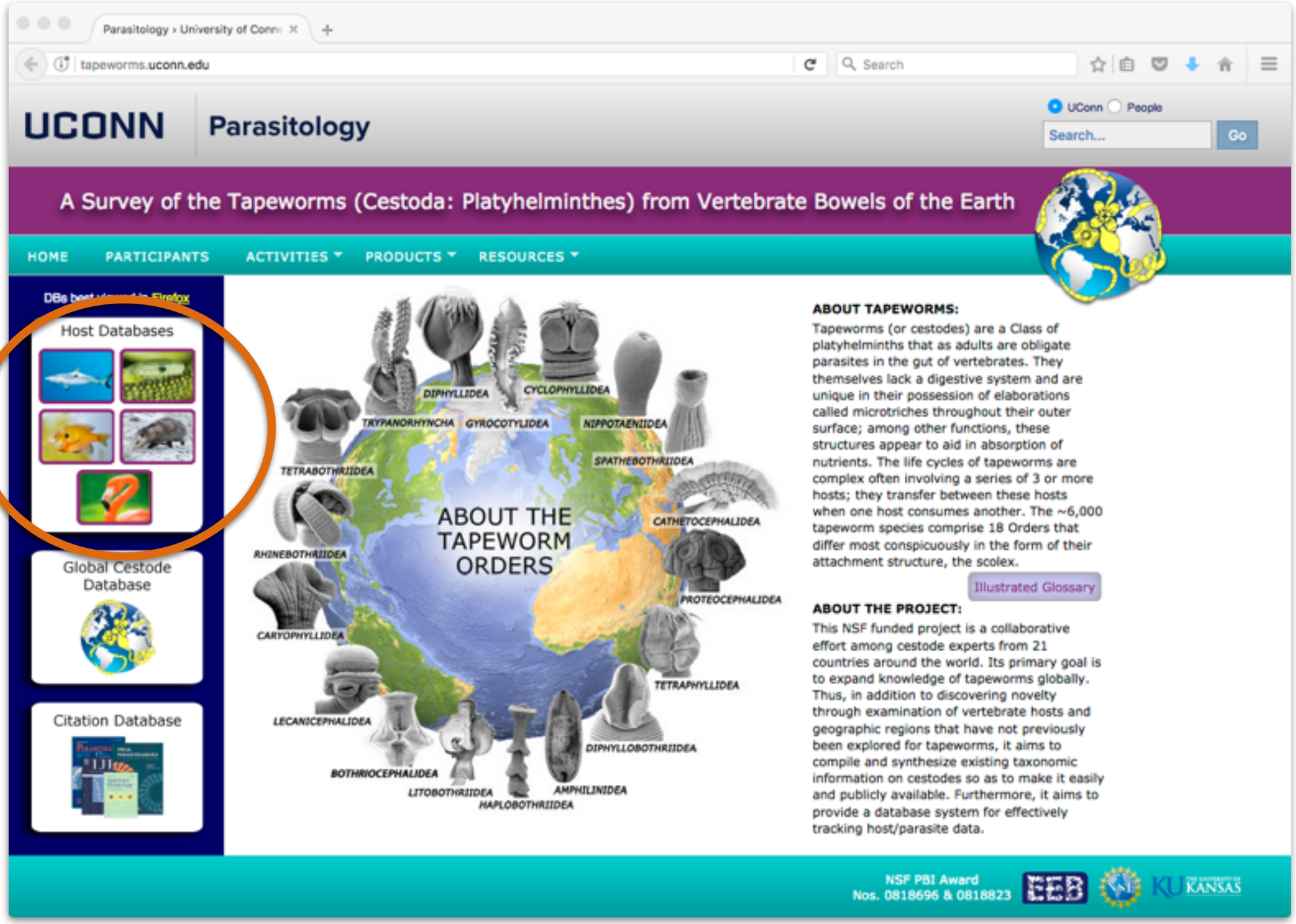


Dissemination

of citations: **3,887**



Dissemination



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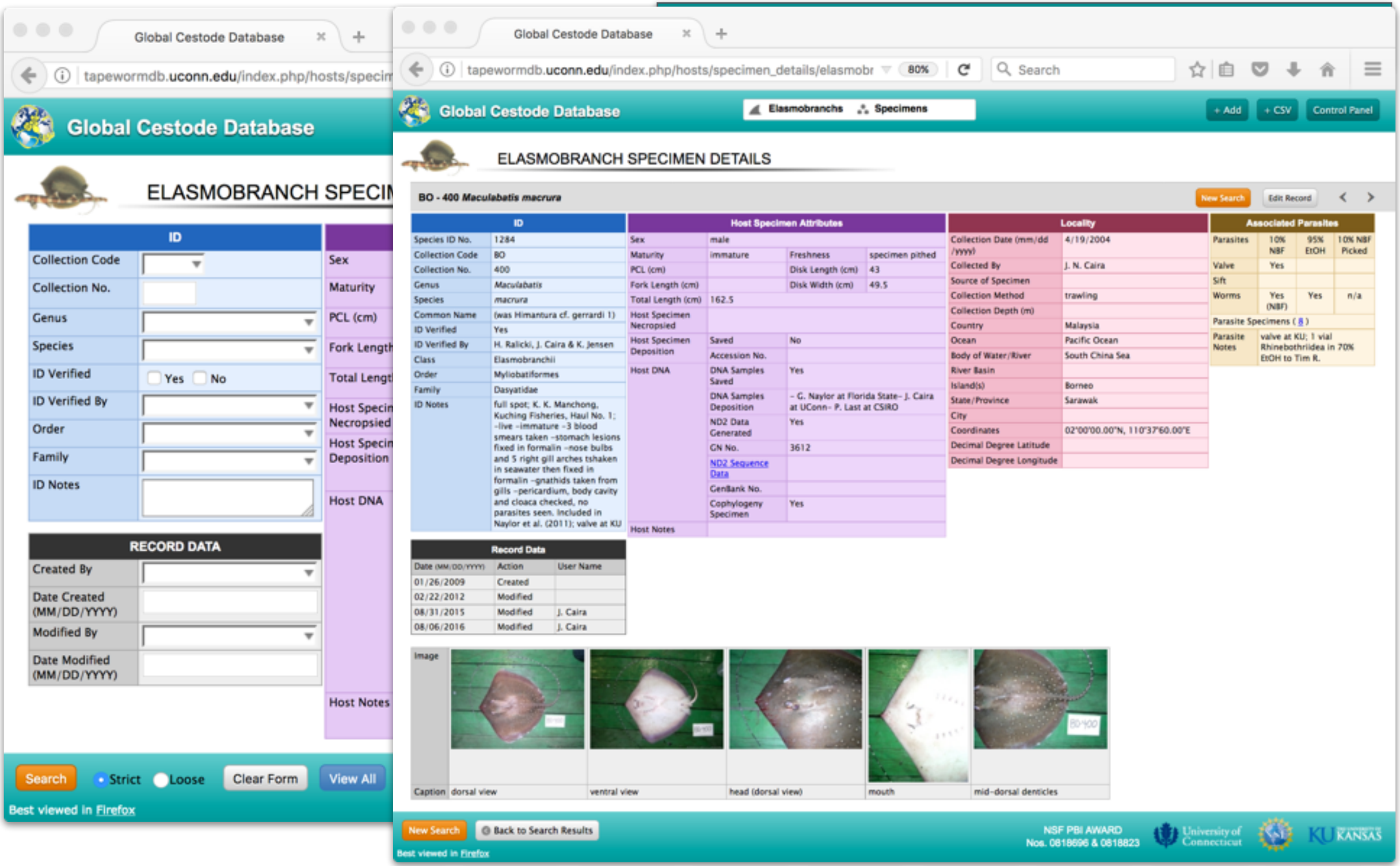
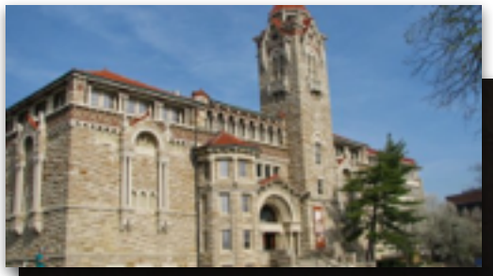


Outreach



University of Kansas,
Natural History Museum

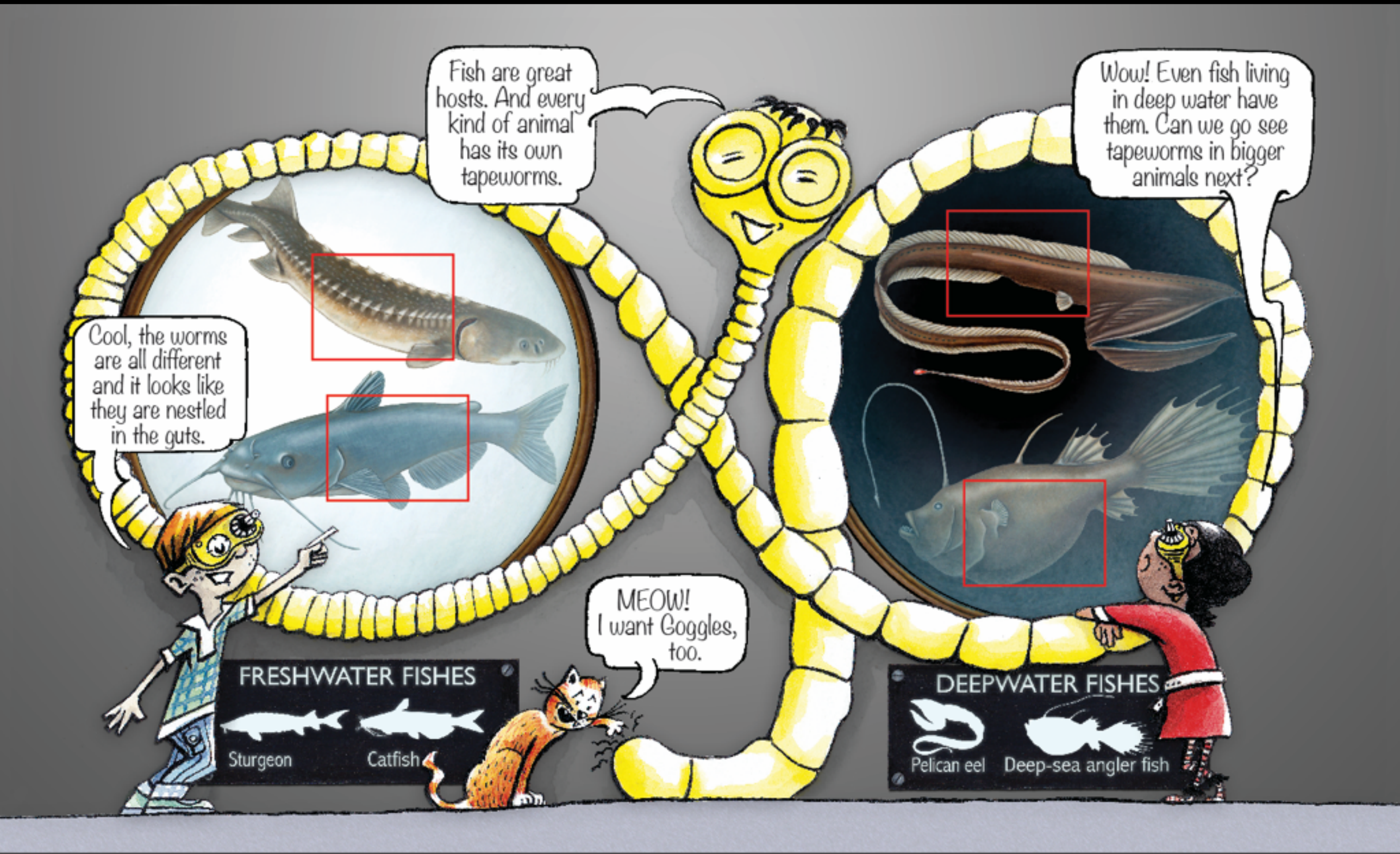
Chervy

MEET THE SUCKERS

MEET THE SUCKERS

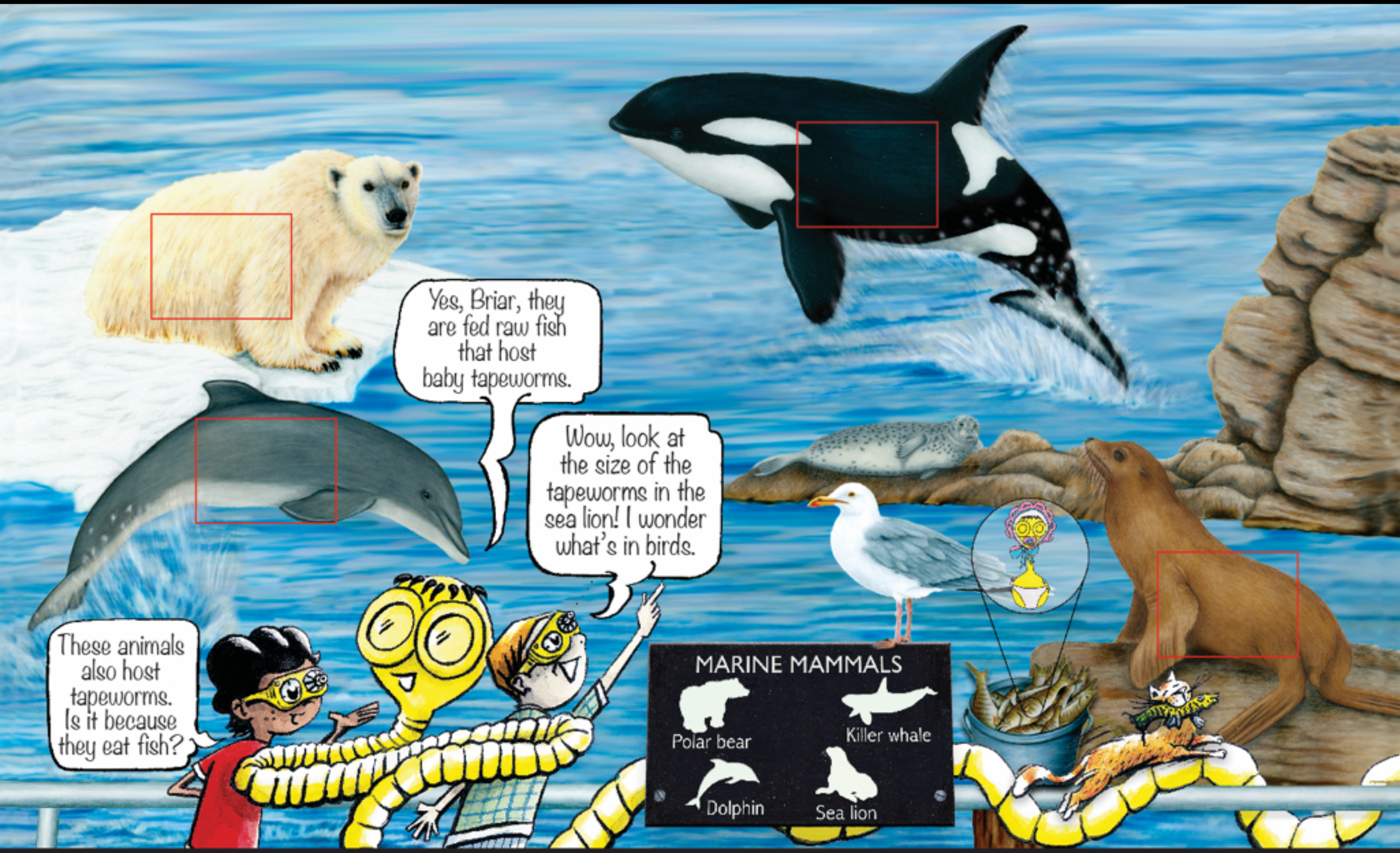
A book about tapeworms
by Lenta Chervy

Cyri, the spokesworm, arrives with Worm Wear Goggles for Briar and Jacob and opens up for them a whole new exciting world that had been hidden to them until now.



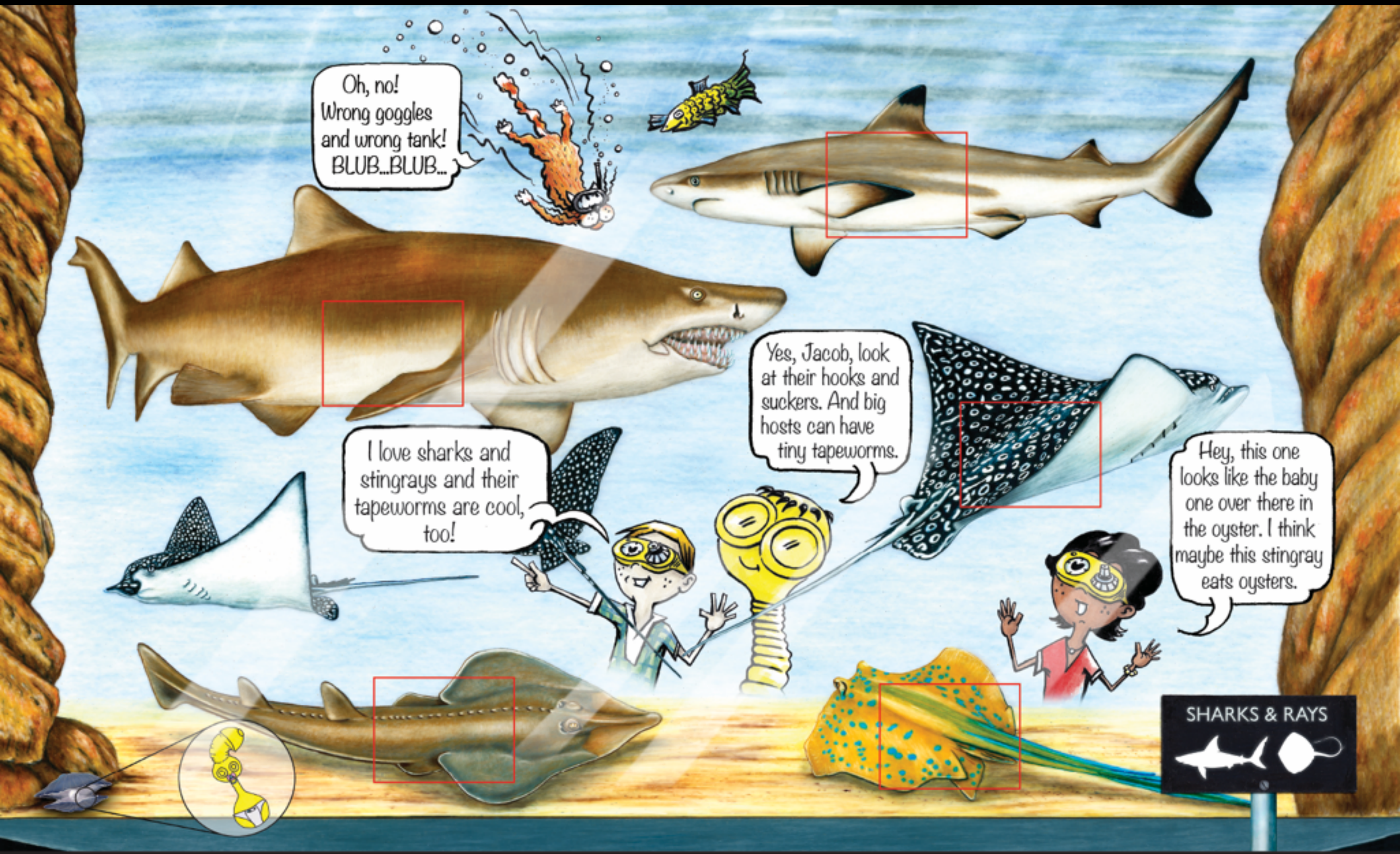
At the Aquarium, with Cyri and their Worm Waer Goggles, the kids begin to see that most animals have tapeworms that live inside of them. Different kinds of tapeworms,...

...live in differnt kinds of animals. In their hosts, tapeworms are snuggled into the surface of their host's gut. Except for Cyri, tapeworms cannot live outside their hosts.



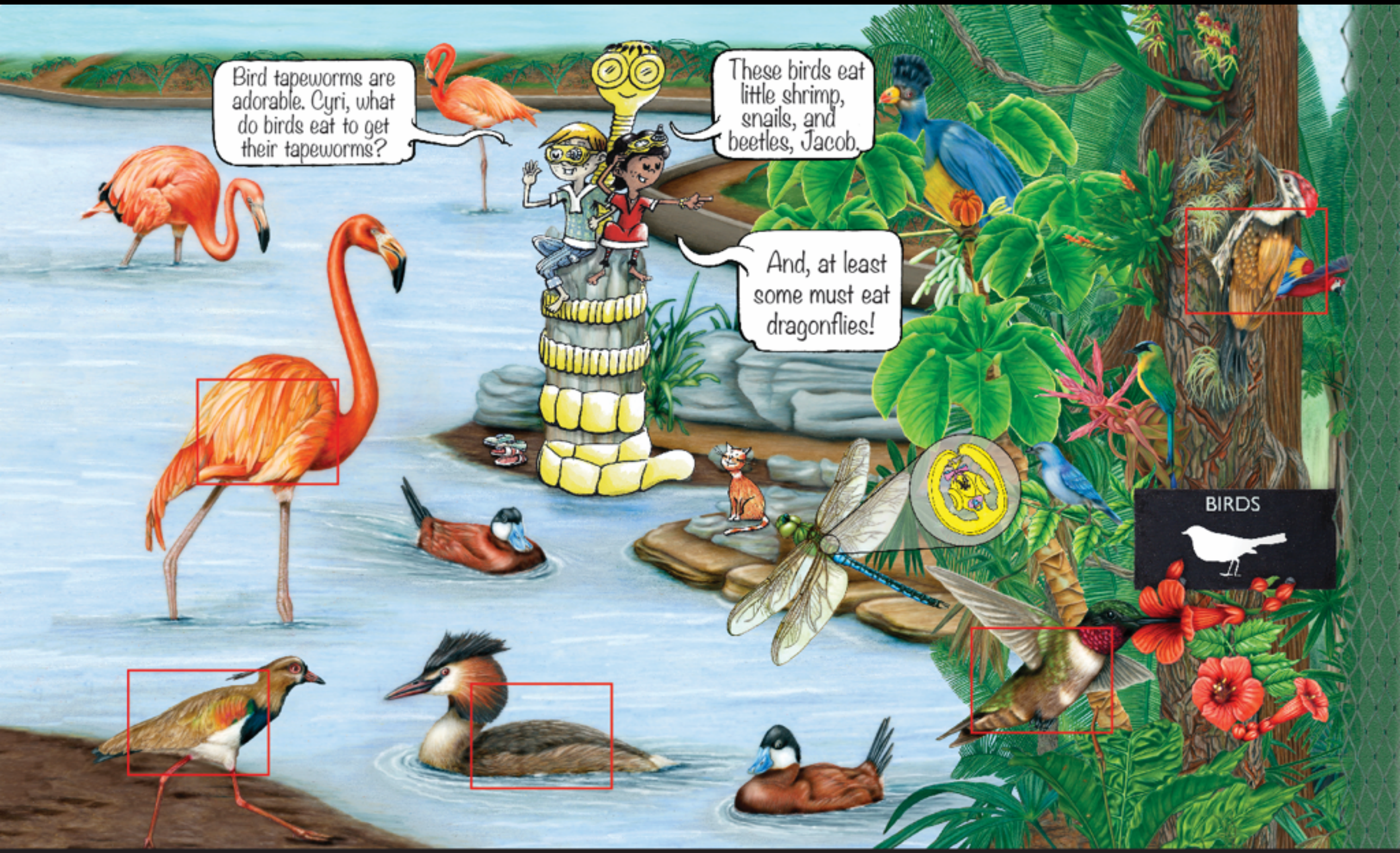
In the marine mammal exhibit, Briar and Jacob see their second baby tapeworm and learn that hosts get their tapeworms from food, such as raw fish.

They see one of the biggest tapeworms there inside of a killer whale. They also see that animals that live in ice, like polar bears, can have tapeworms.



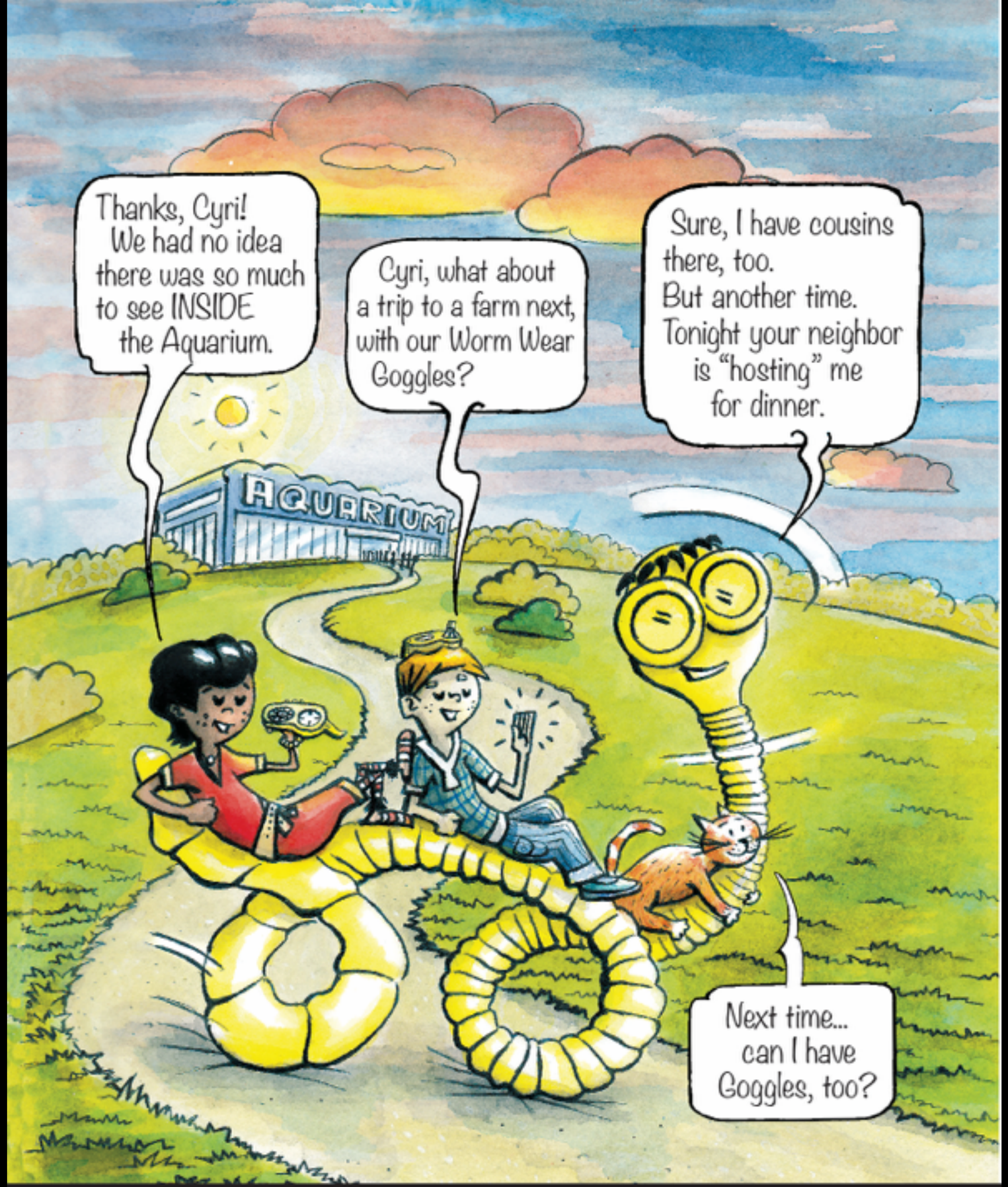
In the shark and stingray tanks, Briar and Jacob see all sorts of beautiful tapeworms. Some sharks and stingrays even host more than one kind of tapeworm.

They see that each type of tapeworm attaches to the gut in its own unique way. Living in a scallop on the floor of the tank they also see their first baby tapeworm.



It turns out that all sorts of birds also host tapeworms—wading birds, ducks, flamingos, woodpeckers, and even hummingbirds.

Many of the tapeworms of birds are funny little creatures. The tapeworms of wading birds are so small that as babies they live in dragonflies.



Watch out for the next adventure of Briar and Jacob and their spokesworm Cyri when they "meet the suckers" of farm animals.

Publications

2017

of publications: **220+**

Alves, P. V., A. de Chambrier, J. L. Luque, and T. Scholz. 2017. Untangling convoluted taxonomy of *Chambr* Proteocephalidae), with erection of *Riggenbachiella* n. g. and the description of a new species from pimelodid Parasitology **94:** 367–389.

Beveridge, I., M. Haseli, V. A. Ivanov, A. Menoret, and B. J. Schaeffner. 2017. Trypanorhyncha Diesing, 1863. *In* Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. J. N. Caira and K. Jensen (eds.). University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, pp. 401–429.

Bueno, V. M.† and J. N. Caira. 2017. Redescription and molecular assessment of relationships among three species of *Echeneibothrium* (Rhinebothriides: Echeneibothriidae) parasitizing the yellownose skate, *Dipturus chilensis*, in Chile. Journal of Parasitology **103:** 268–284.

Caira, J. N., V. M. Bueno†, and K. Jensen. 2017. Cathetocephalidea Schmidt & Beveridge, 1990. *In* Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. J. N. Caira and K. Jensen (eds.). University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, pp. 65–76.

Caira, J. N., K. Gallagher†, and K. Jensen. 2017. Litobothriidea Dailey, 1969. *In* Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. J. N. Caira and K. Jensen (eds.). University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, pp. 231–241.

Caira, J. N., C. J. Healy, F. P. L. Marques, and K. Jensen. 2017. Three new genera of rhinebothriidean cestodes from stingrays from Southeast Asia. Folia Parasitologica **64:** 008 (18 pp.).

Caira, J. N., V. Ivanov, K. Jensen, and F. P. L. Marques. 2017. Diphyllidea van Beneden in Carus, 1863. *In* Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. J. N. Caira and K. Jensen (eds.). University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, pp. 149–166.

Caira, J. N. and K. Jensen (eds.). 2017. Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, 463 pp.

Caira, J. N., K. Jensen, B. B. Georgiev, R. Kuchta, D. T. J. Littlewood, J. Mariaux, T. Scholz, V. V. Tkach, and A. Waeschenbach. 2017. An overview of tapeworms from vertebrate bowels of the earth. *In* Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. J. N. Caira and K. Jensen (eds.). University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, pp. 1–20.

Caira, J. N., K. Jensen, and V. A. Ivanov. 2017. Onchoproteocephalidea II Caira, Jensen, Waeschenbach, Olson & Littlewood, 2014. *In* Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. J. N. Caira and K. Jensen (eds.). University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, pp. 279–304.

Caira, J. N., K. Jensen, and T. R. Ruhnke. 2017. "Tetraphyllidea" van Beneden, 1850 relics. *In* Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth. J. N. Caira and K. Jensen (eds.). University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, KS, USA, pp. 371–400.

de Ch brier, A. T Scholz, J. M x, and R. K hta. 2017. O hoproteoc lidea I Ca Jensen, W nbach, O & Littlew 2014. *In* P tary ty 200 ew Ve vel h. an (ed ity Na y