Sea Creatures

aquatic invertebrates of the past

Matthew C. Brennan

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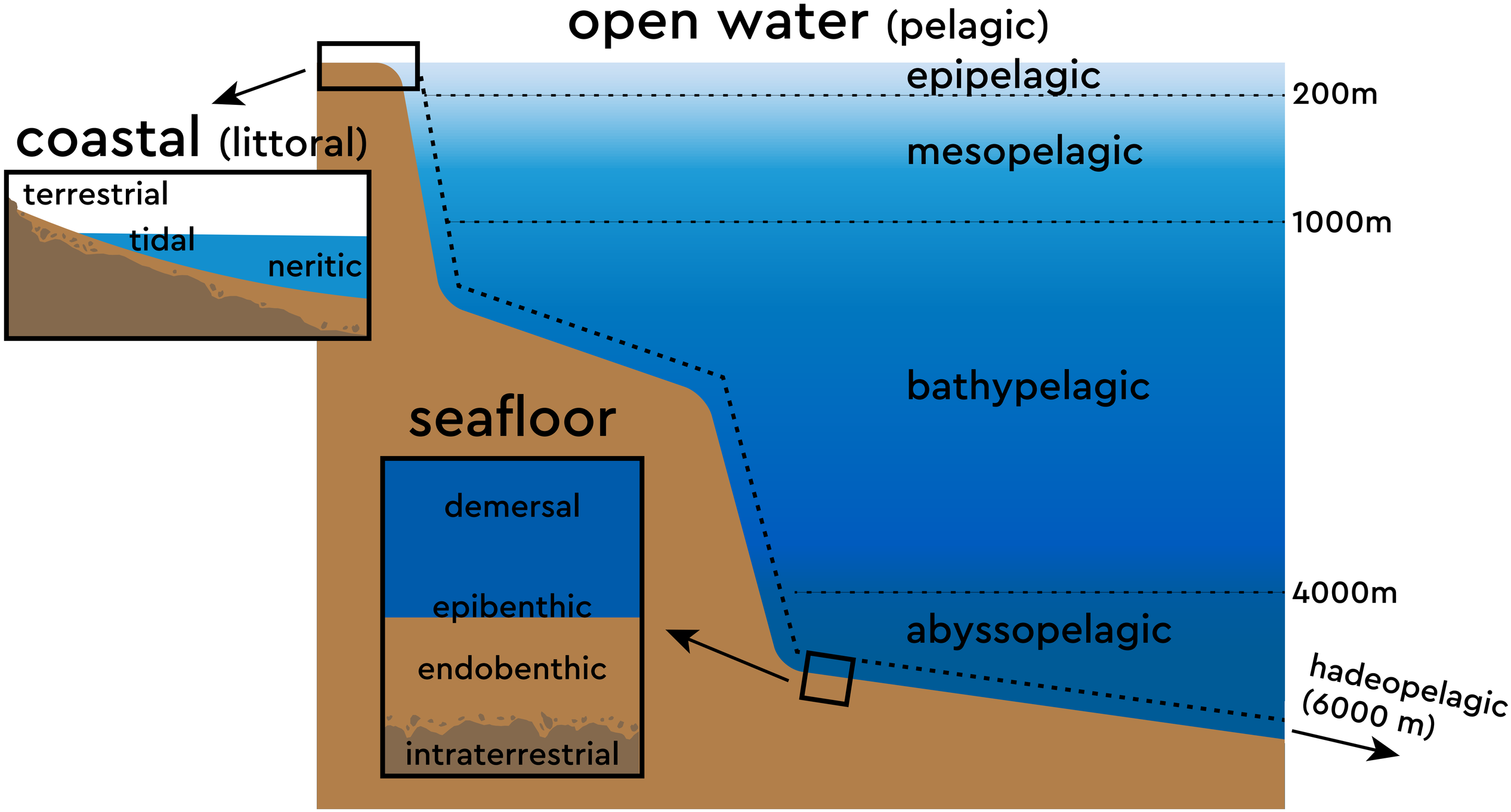
open water (pelagic)
epipelagic
200m
mesopelagic
1000m
bathypelagic
4000m
abyssopelagic
hadeopelagic
(6000 m)
coastal (littoral)
terrestrial
tidal
neritic
seafloor
demersal
epibenthic
endobenthic
intraterrestrial

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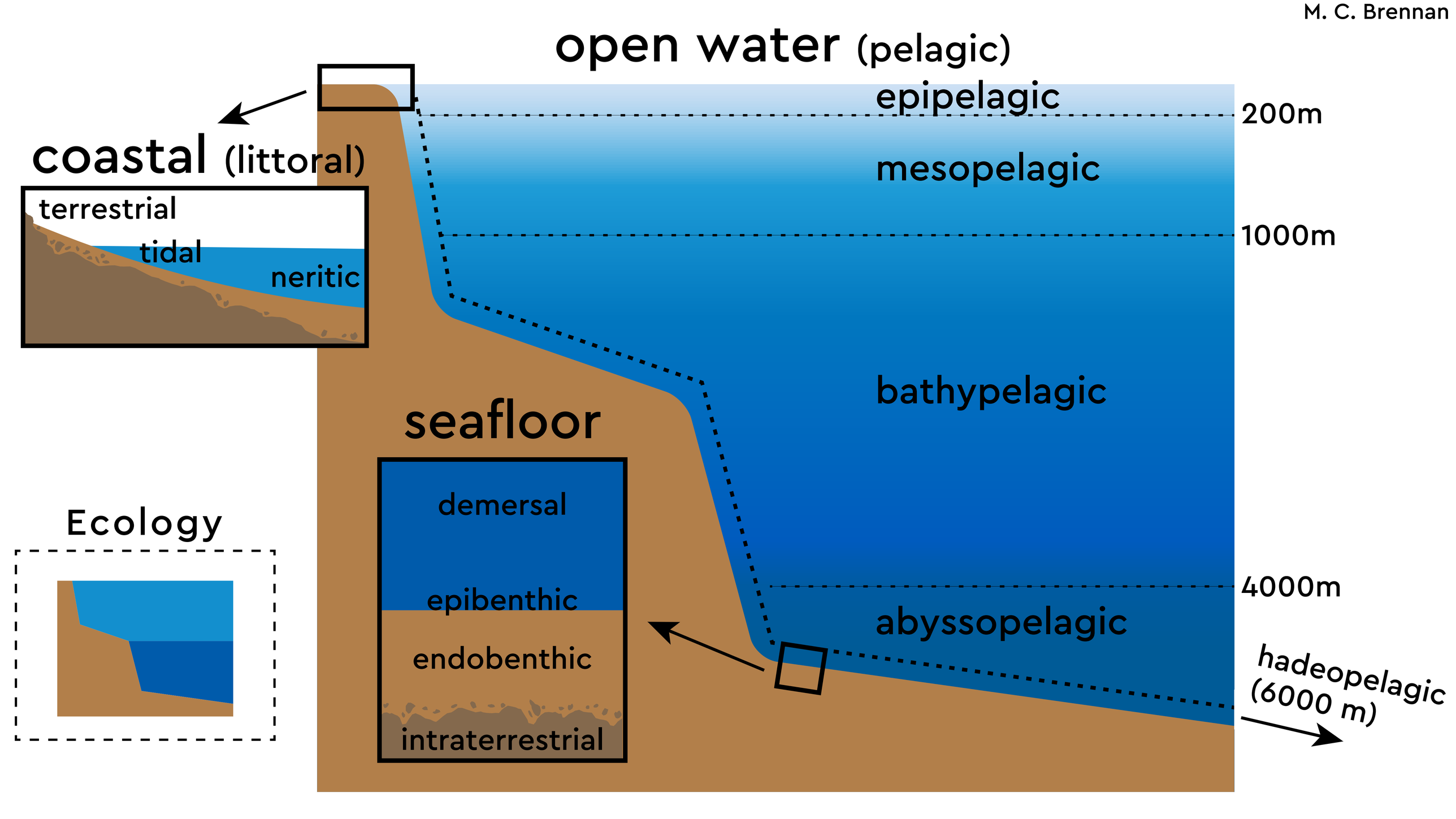
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Ecology

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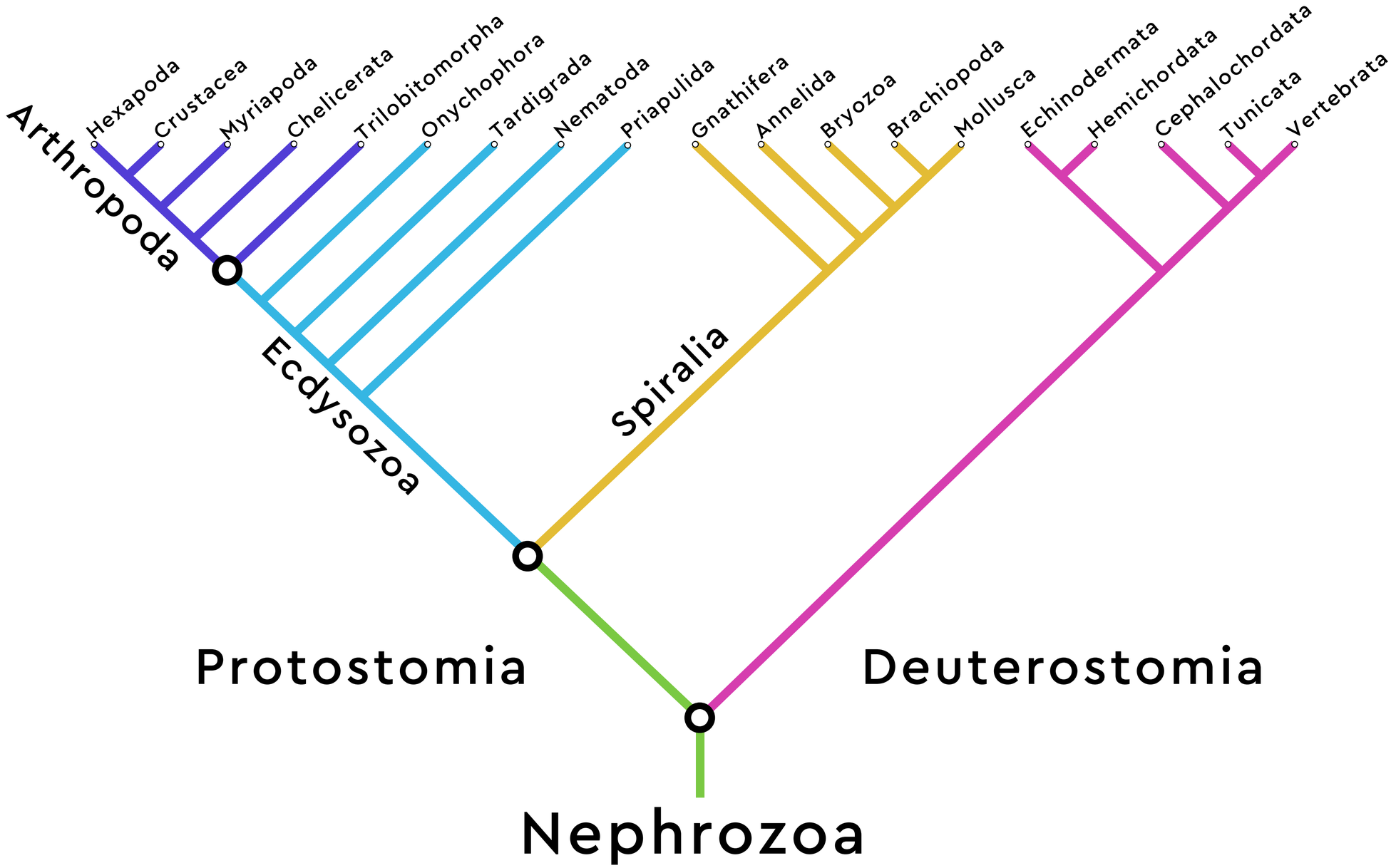
Hexapoda
Crustacea
Myriapoda
Chelicerata
Trilobitomorpha
Onychophora
Tardigrada
Nematoda
Priapulida
Gnathifera
Annelida
Bryozoa
Brachiopoda
Mollusca
Echinodermata
Hemichordata
Cephalochordata
Tunicata
Vertebrata
Arthropoda
Ecdysozoa
Spiralia
Protostomia
Deuterostomia
Nephrozoa

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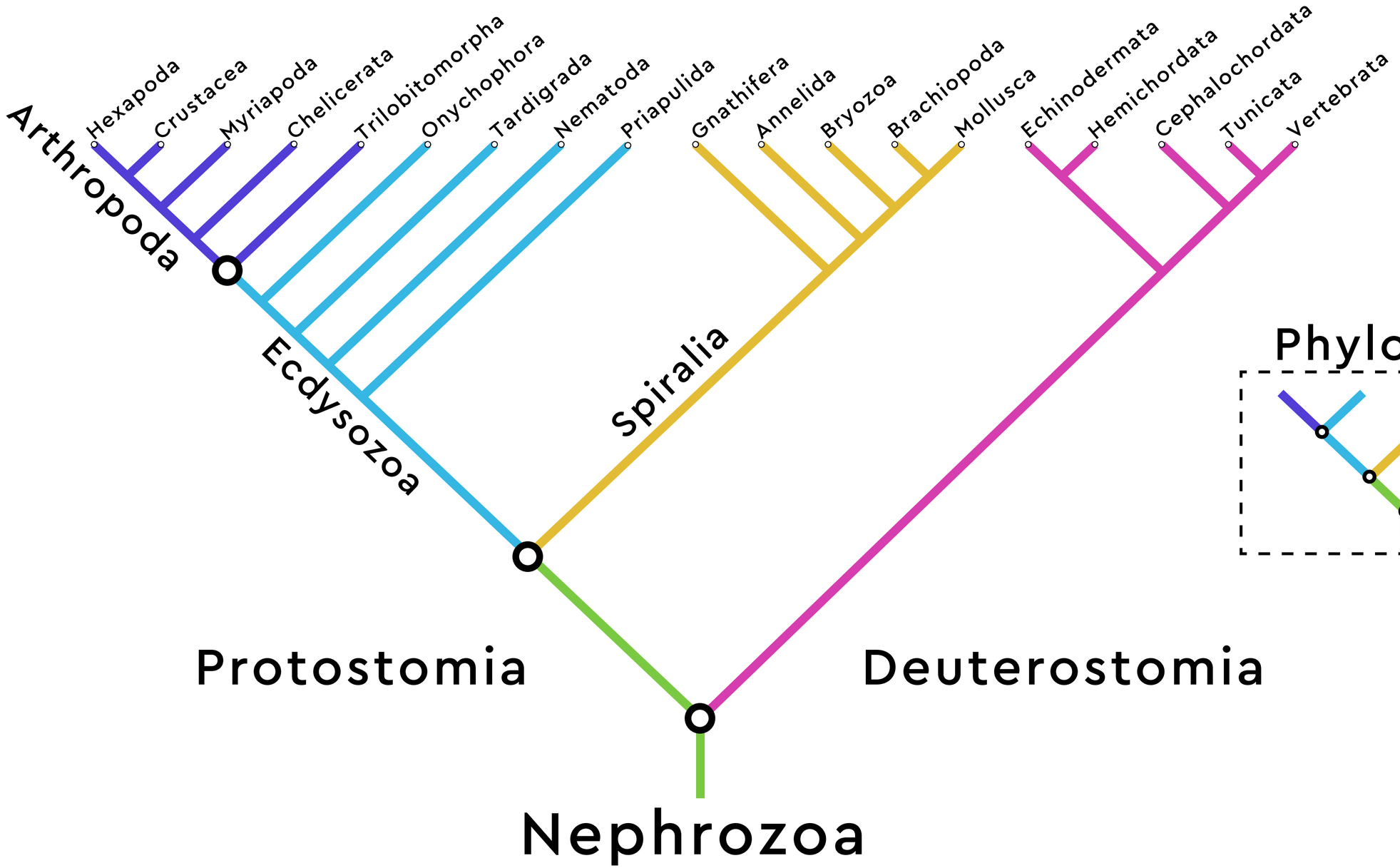
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Vertebrata
Arthropoda
Ecdysozoa
Spiralia
Protostomia
Deuterostomia
Nephrozoa
Phylogeny

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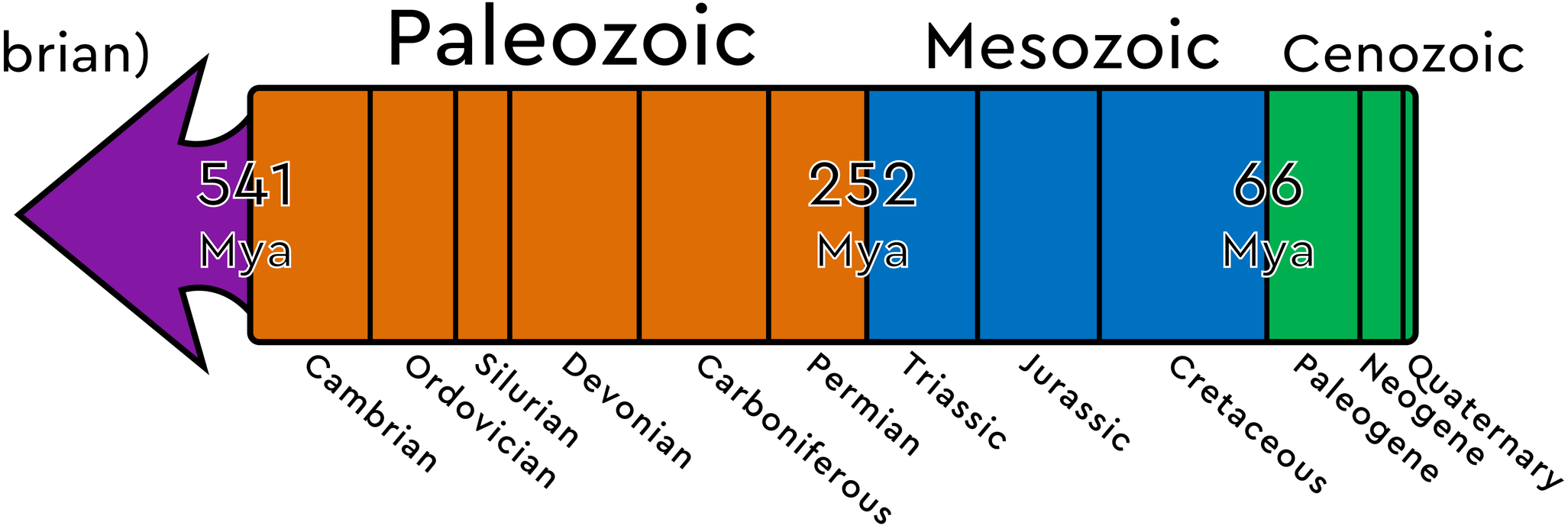
Proterozoic Eon

(Precambrian)

Phanerozoic Eon



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Proterozoic Eon

(Precambrian)

Phanerozoic Eon

Paleozoic

Mesozoic

Cenozoic

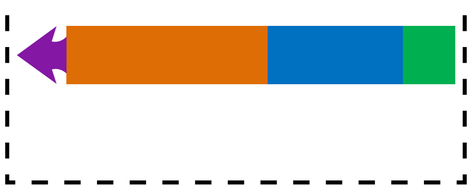
541 Mya

252 Mya

66 Mya

Cambrian
Ordovician
Silurian
Devonian
Carboniferous
Permian
Triassic
Jurassic
Cretaceous
Paleogene
Neogene
Quaternary

Time

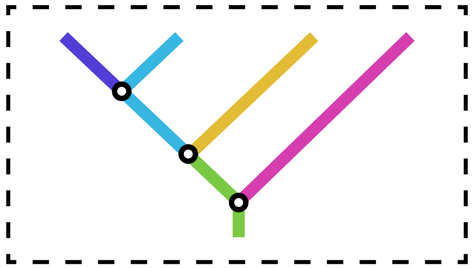


context:

Ecology

(aquatic)

Phylogeny



(invertebrates)

Time

(past)

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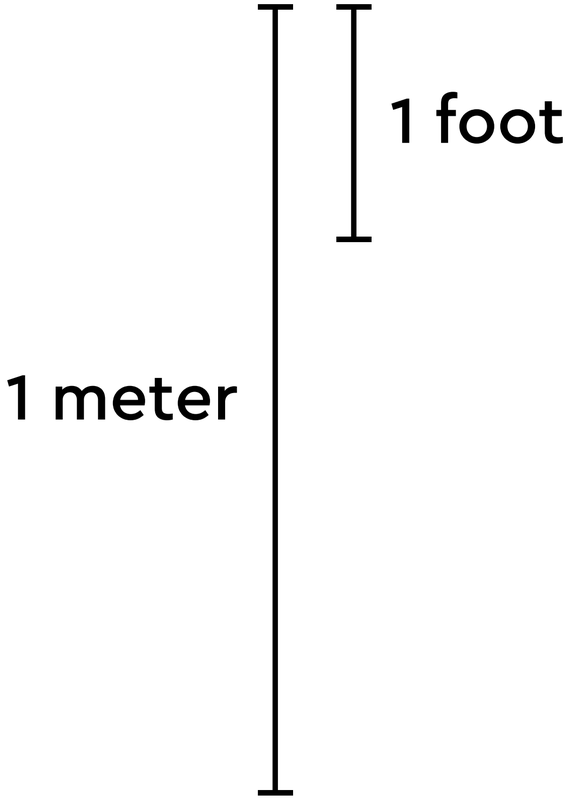
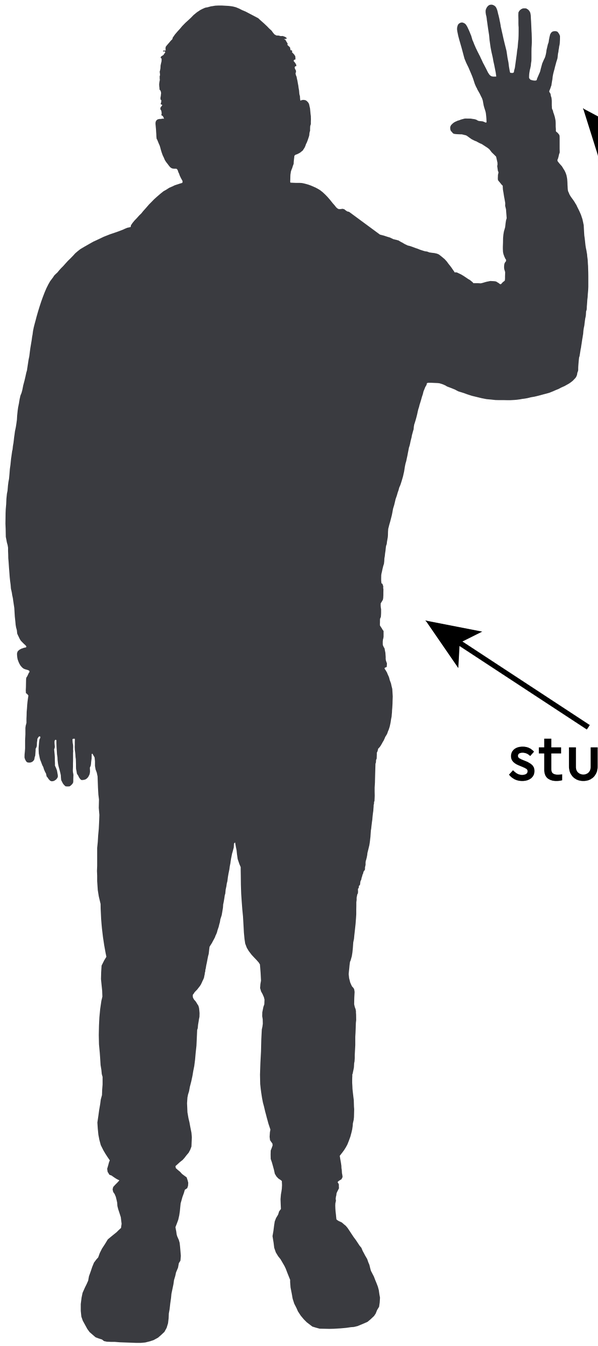
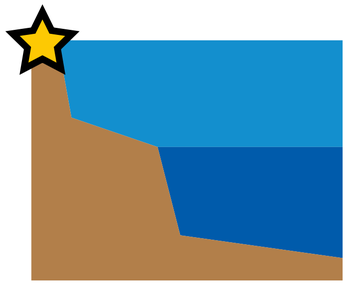
Homo

The paragon of animals

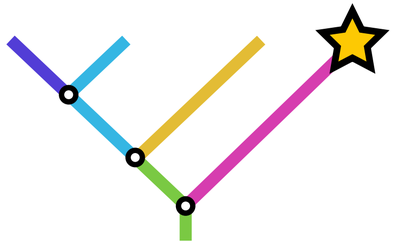






terrestrial

Quaternary



Vertebrate

Charnia

A primordial animal

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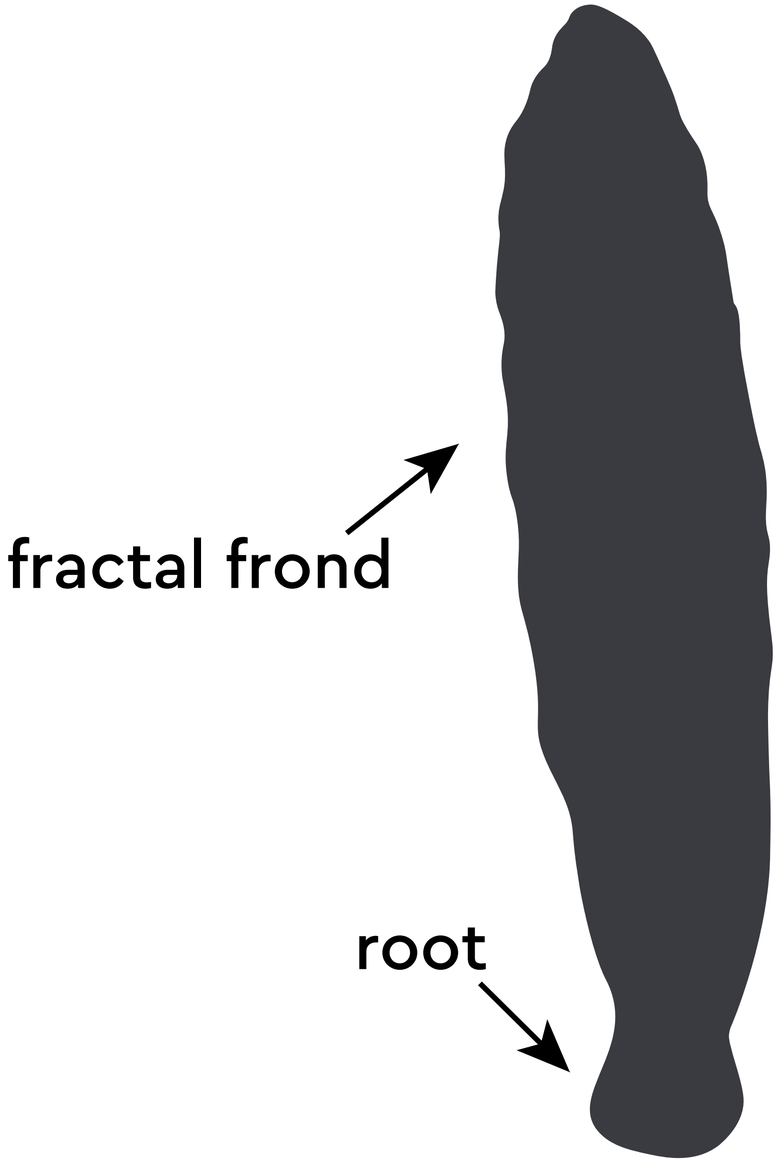
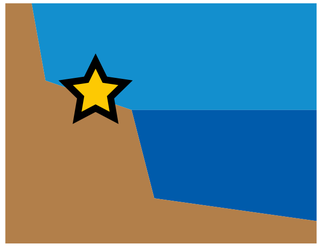
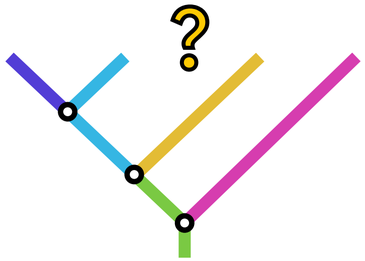




shallow benthic

Precambrian



unknown

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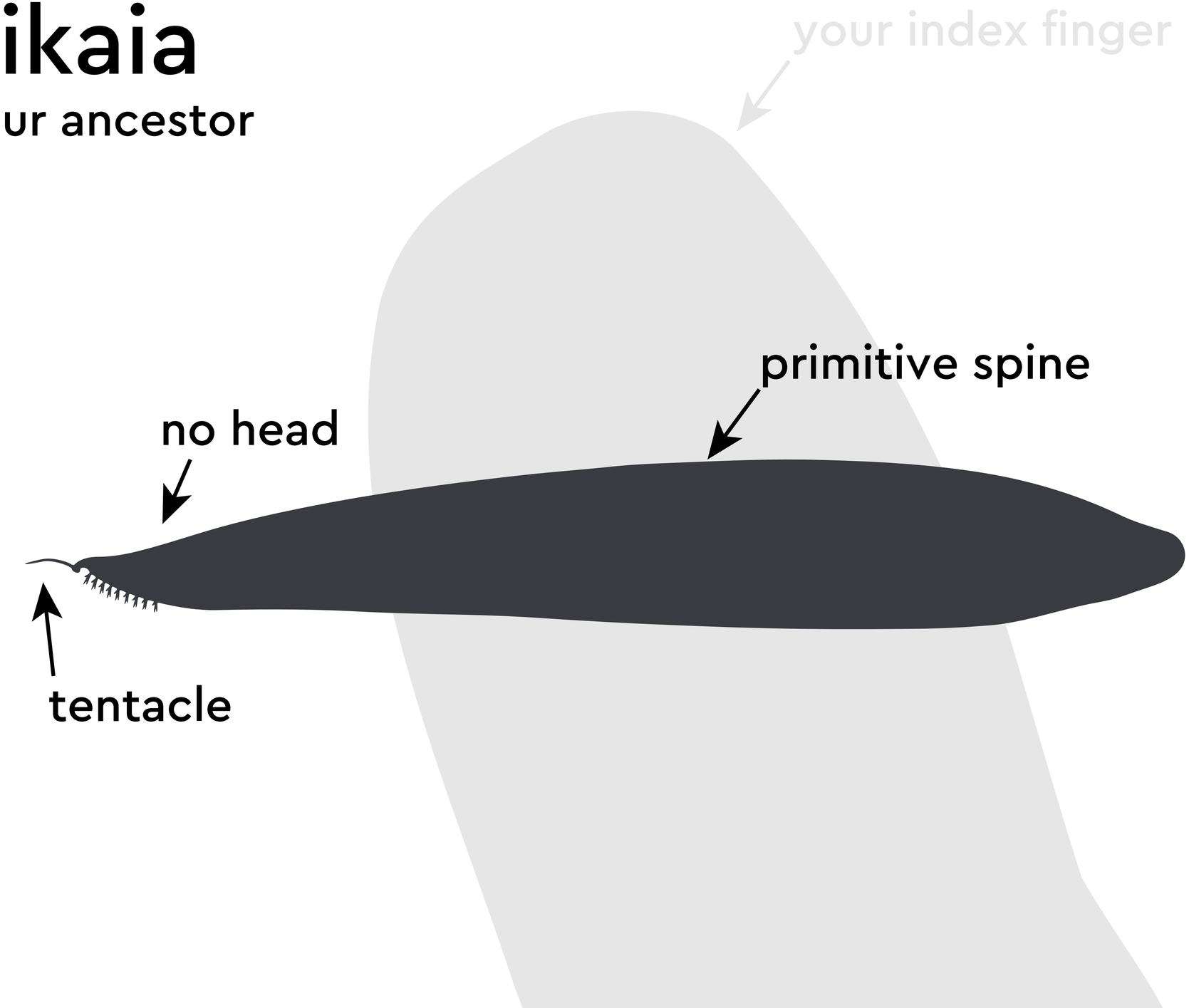
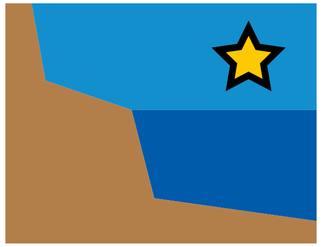
Pikaia

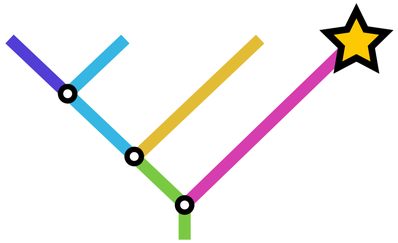
Your ancestor





shallow pelagic

Cambrian



Chordate

Kerygmachela

An arthropod ancestor

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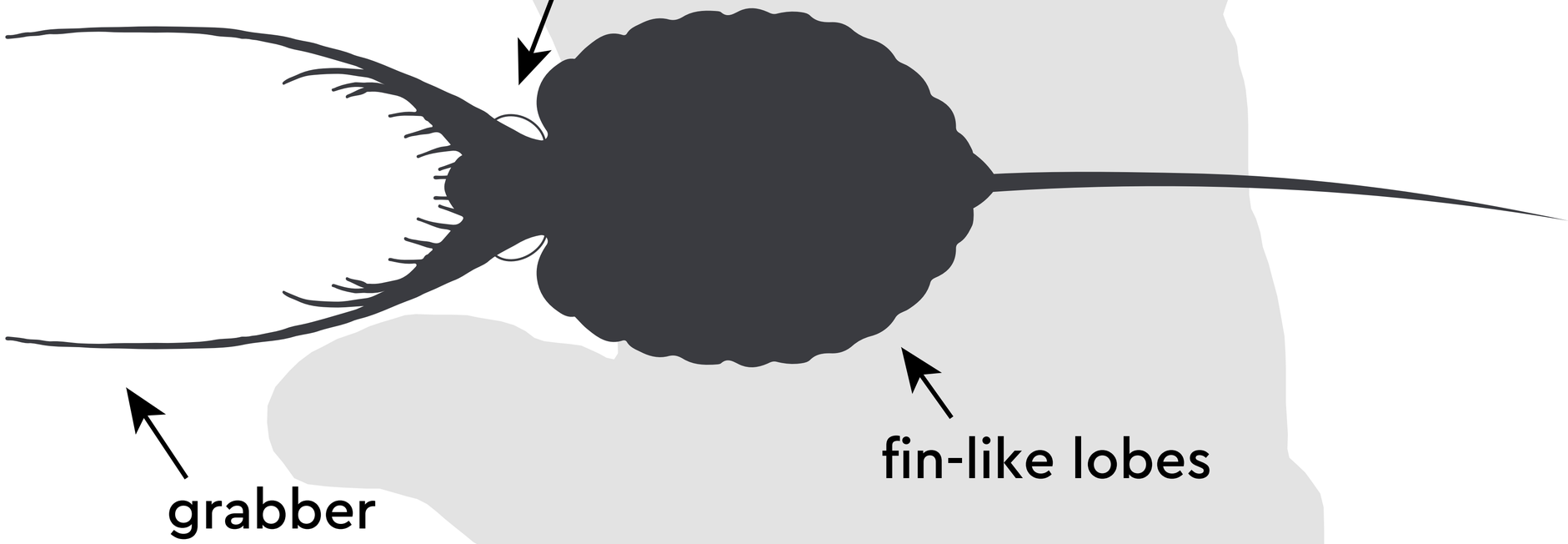
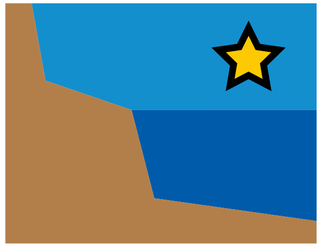
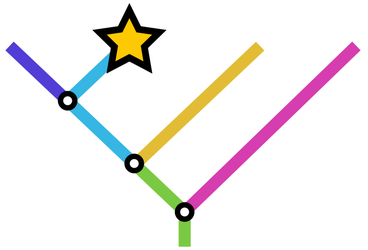




shallow pelagic

Cambrian



Lobopodian

Anomalocaris

The first megacarnivore

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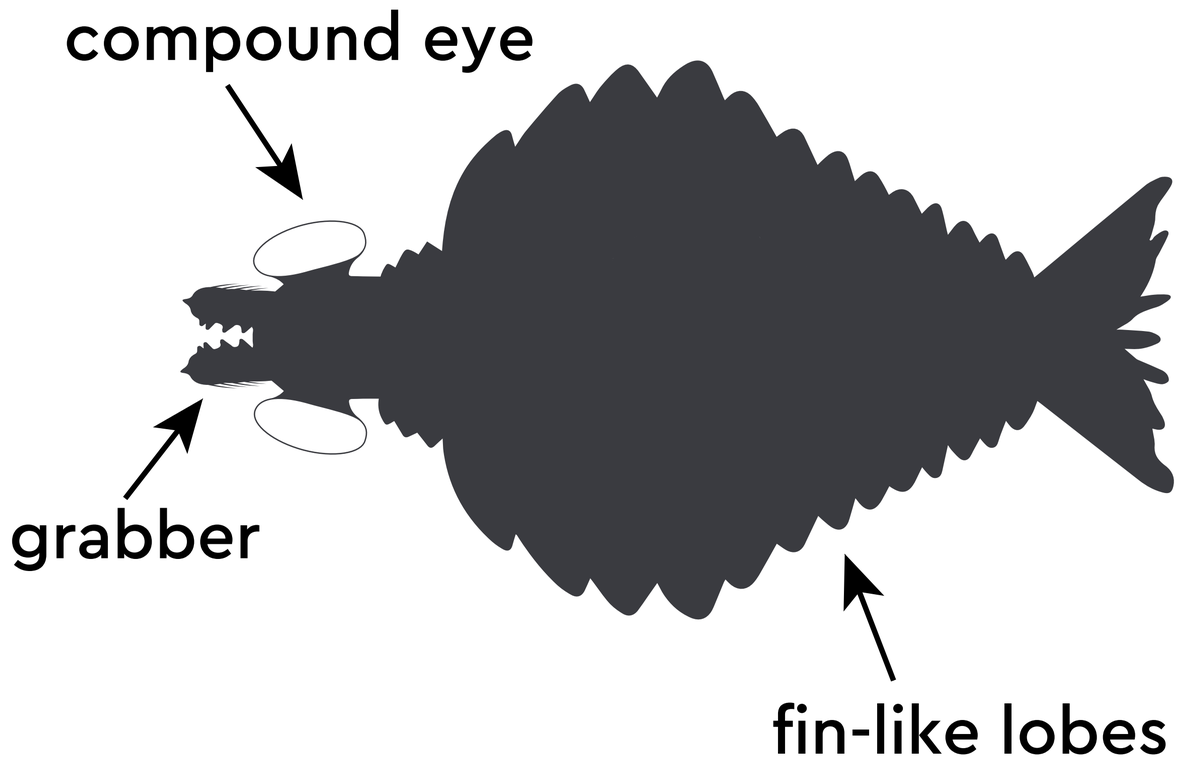
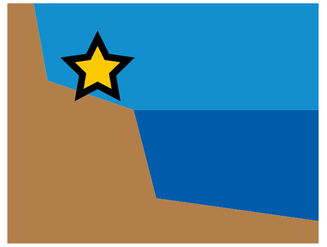
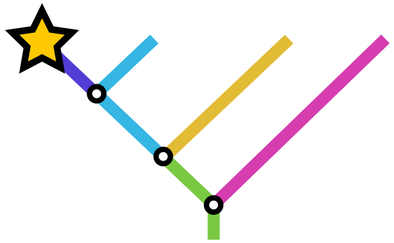




shallow demersal

Cambrian



Radiodont

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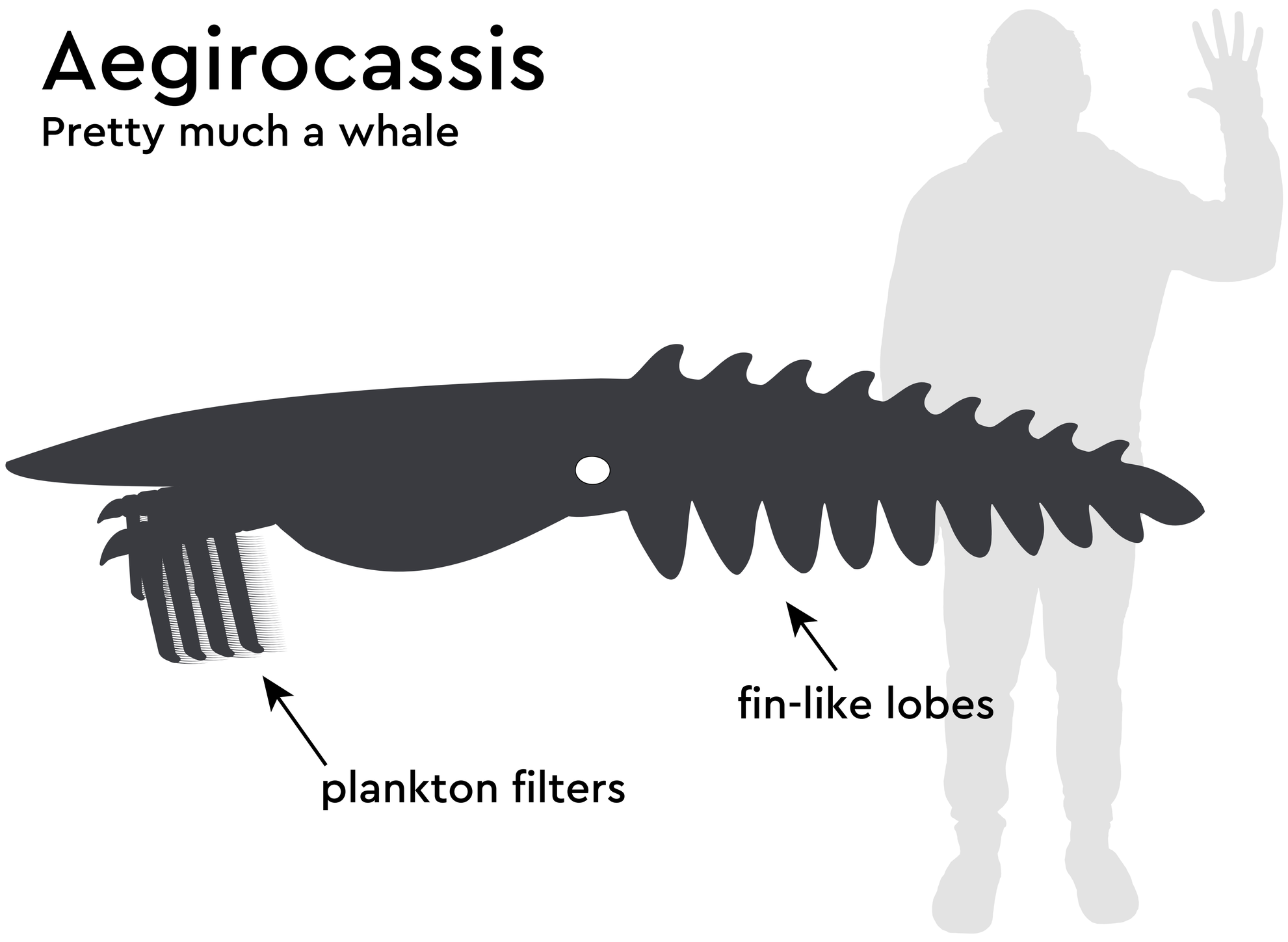
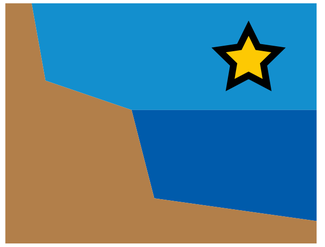
Aegirocassis

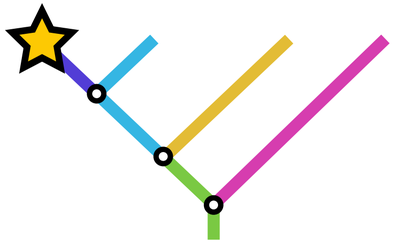
Pretty much a whale





shallow pelagic

Ordovician



Radiodont

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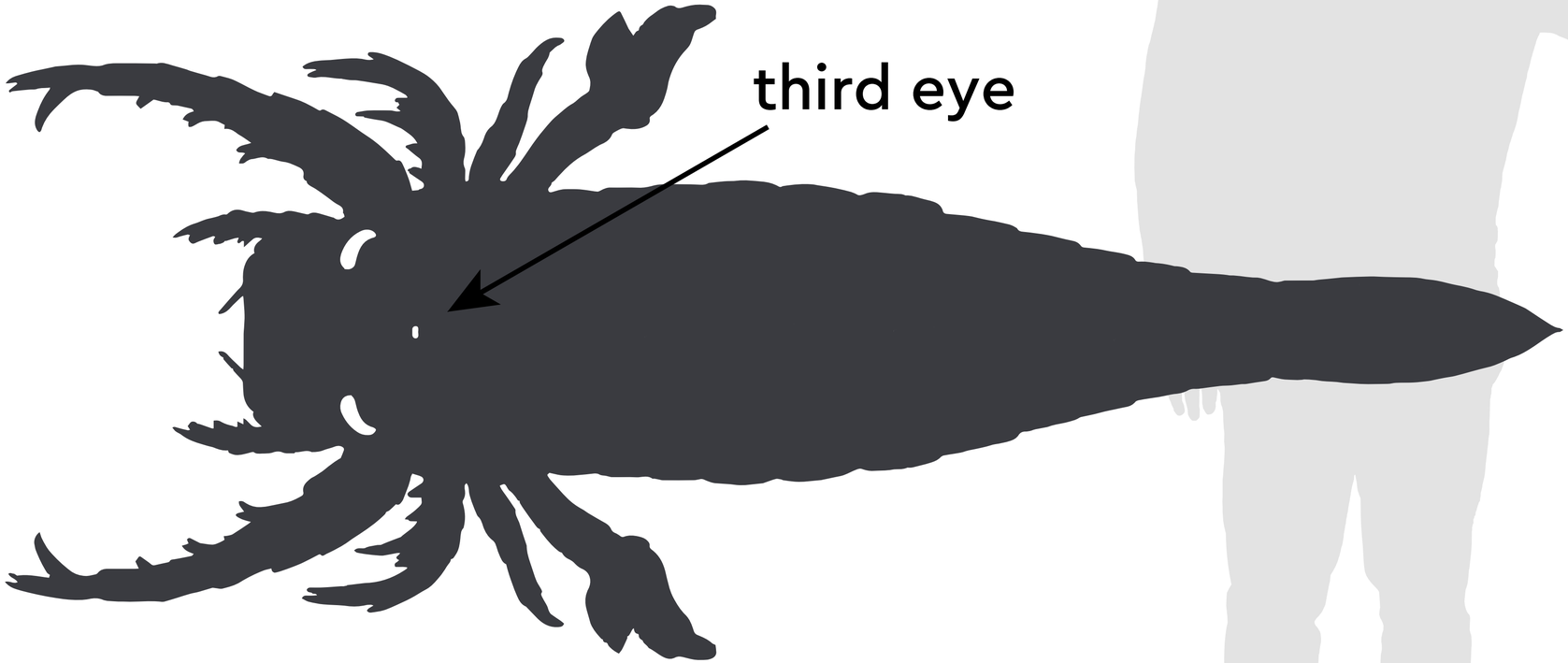
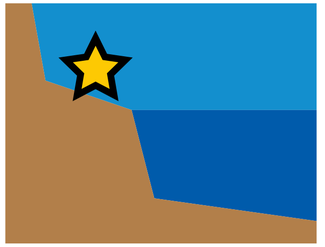
Pentecopterus

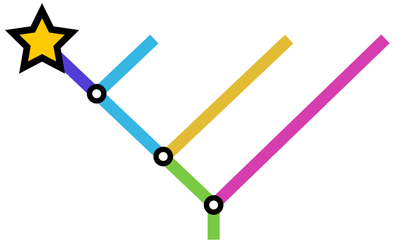
The first sea scorpion





shallow demersal

Ordovician



Eurypterid

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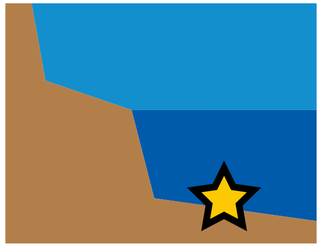
Isotelus

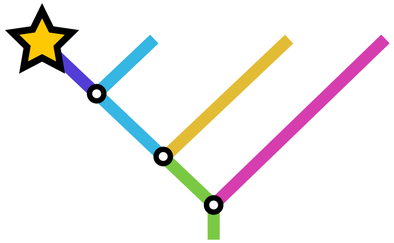
The largest trilobite

symmetrical



deep benthic

Ordovician



Trilobite

Walliserops

A trident-toting trilobite

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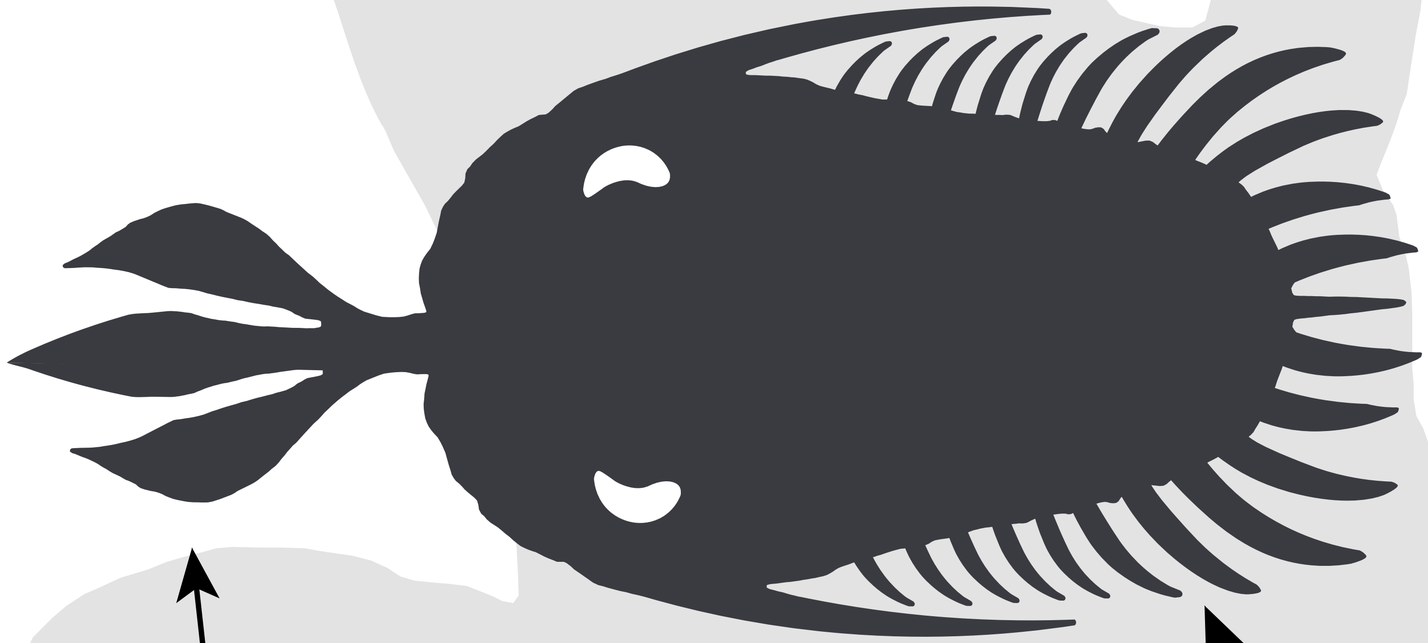
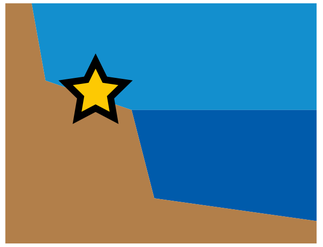


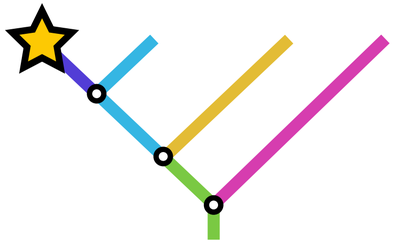
mysterious trident

protective spikes



shallow benthic

Devonian



Trilobite

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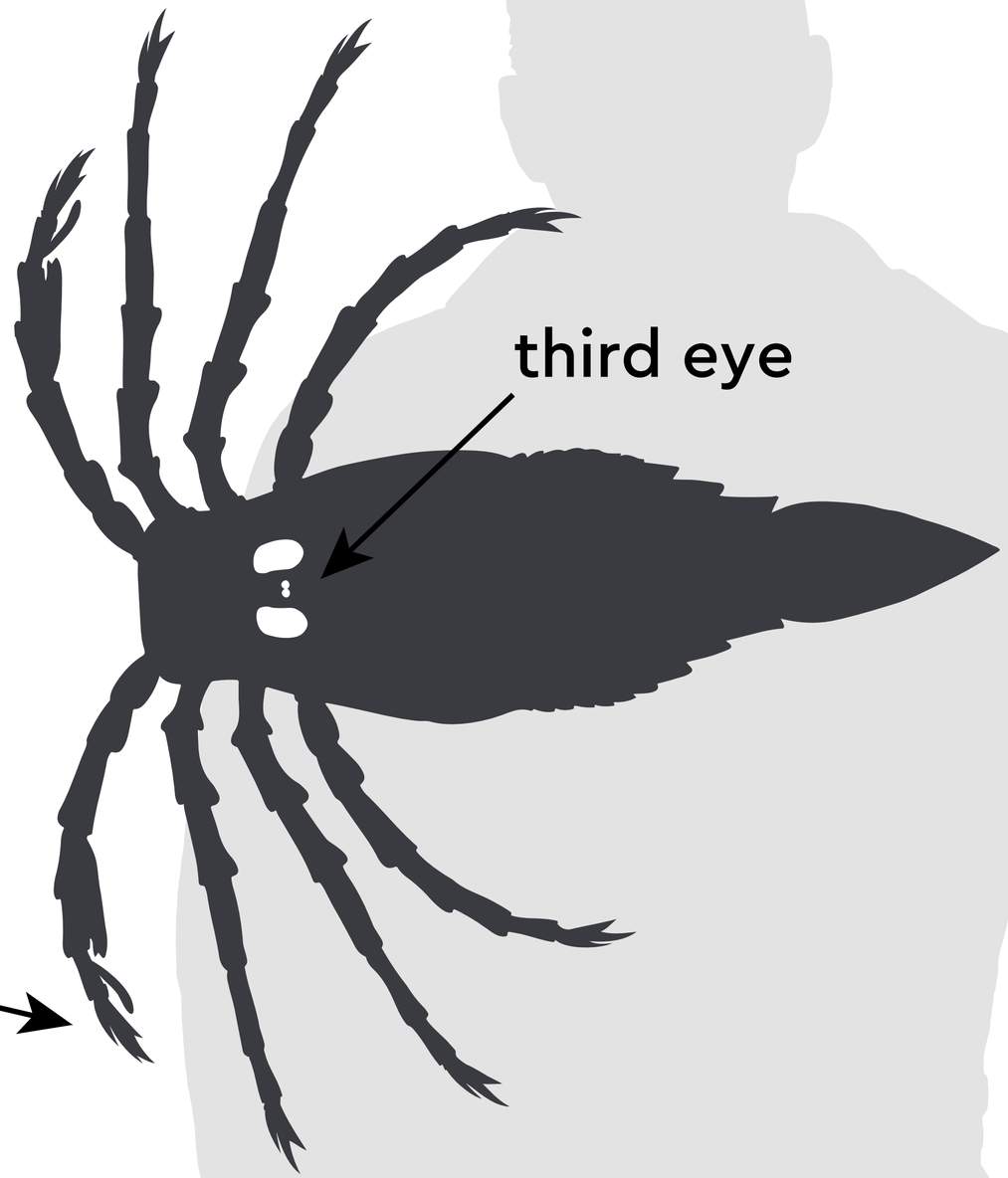
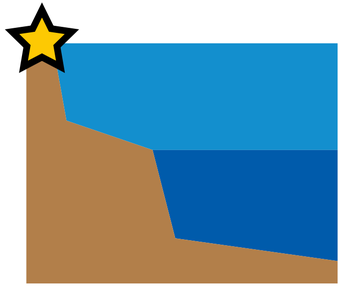
Megarachne

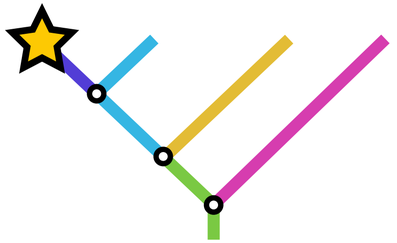
Not a spider





non-marine

Carboniferous



Eurypterid

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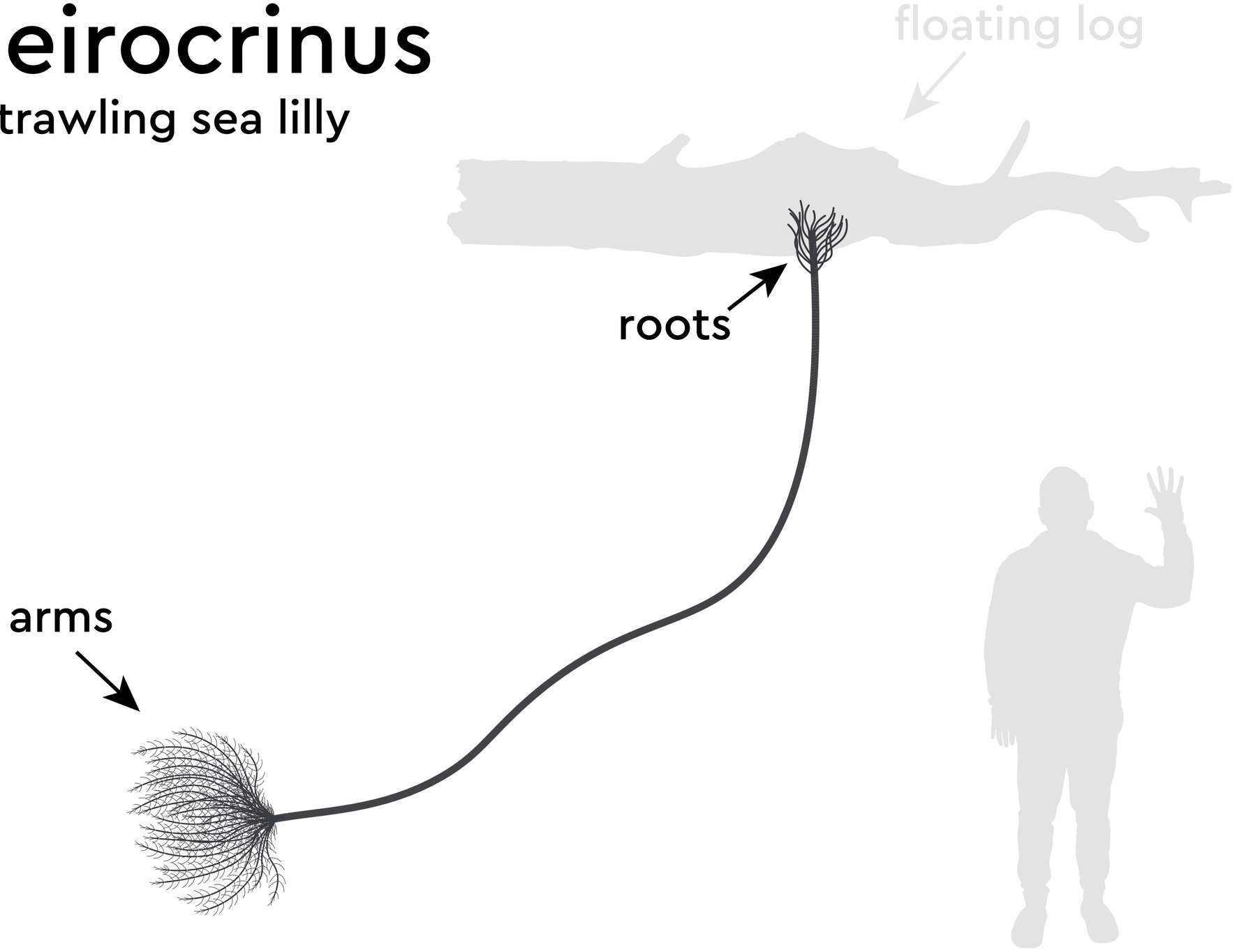
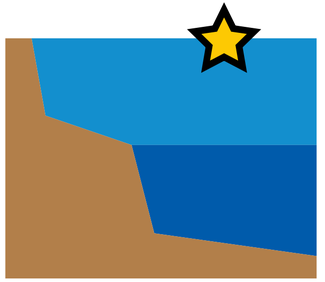
Seirocrinus

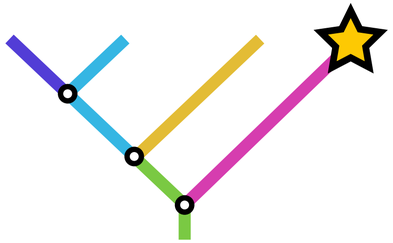
A trawling sea lilly





shallow pelagic

Jurassic



Echinoderm

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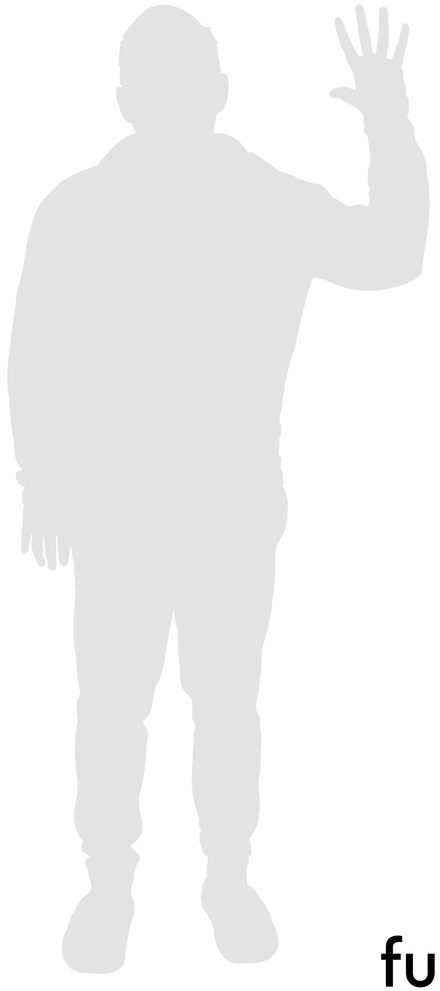
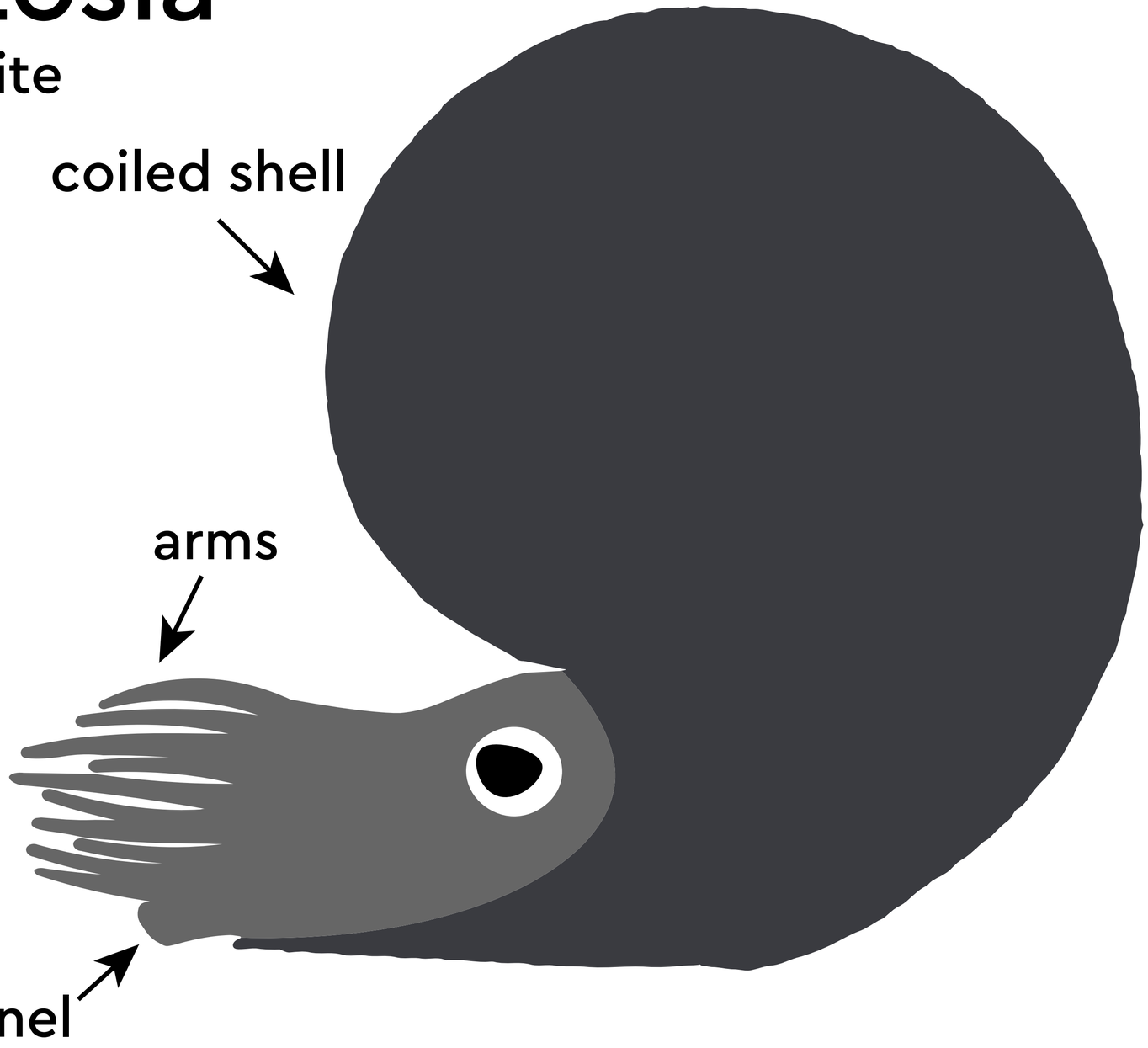
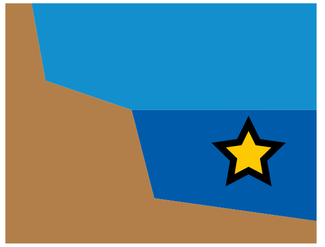
Parapuzosia

A giant ammonite

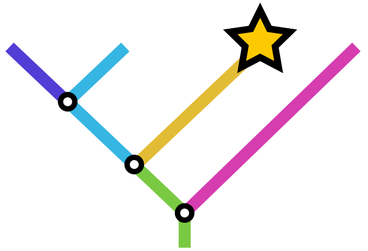






deep pelagic

Cretaceous



Cephalopod

Ancyloceras

An anomalous ammonite

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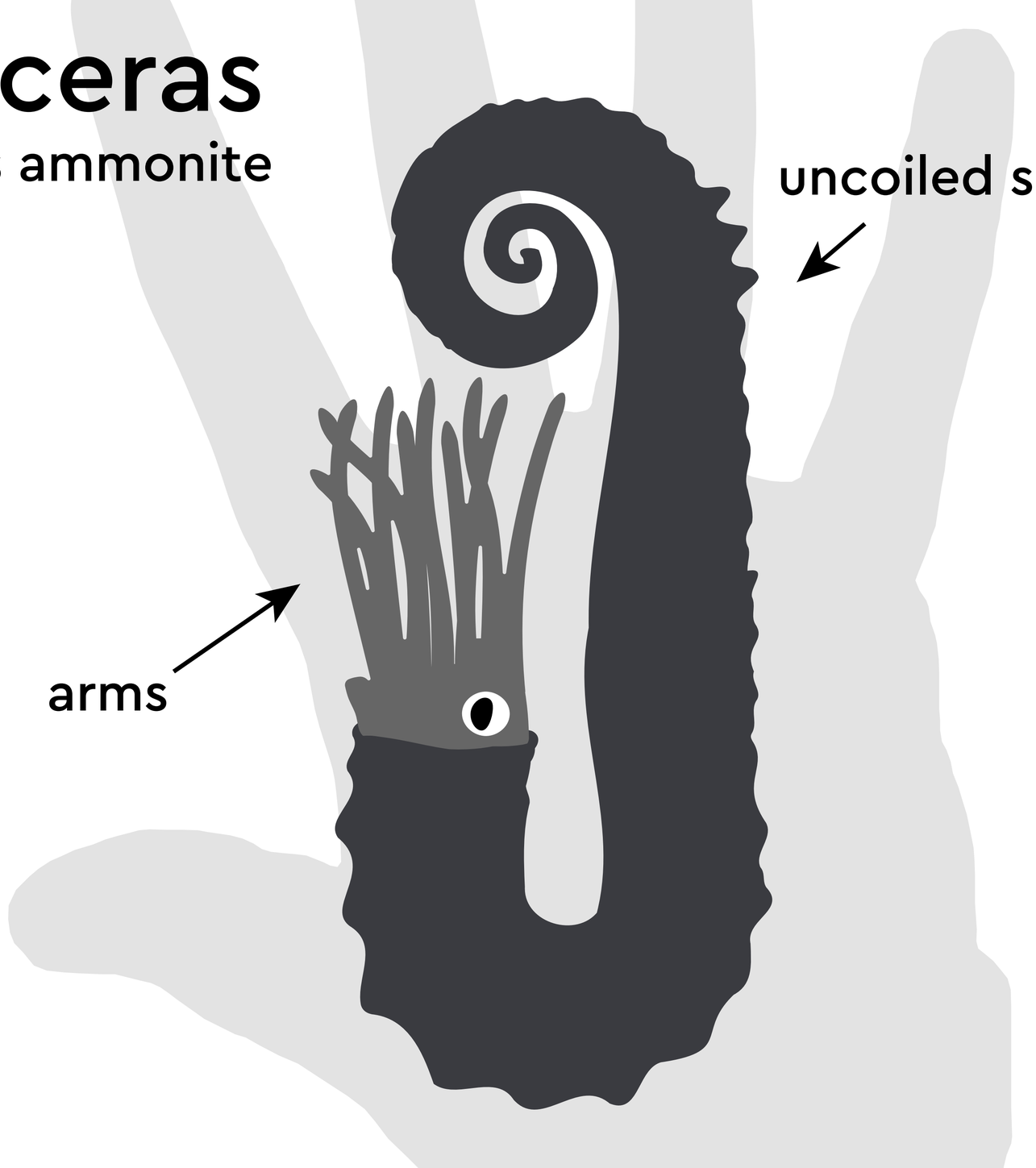
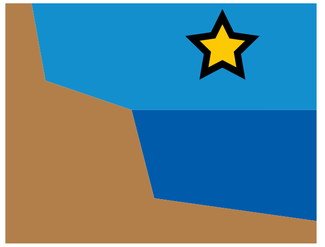
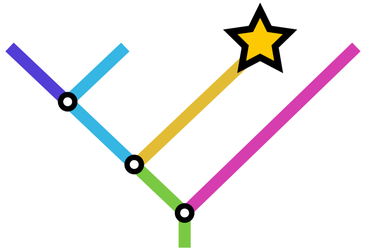




shallow pelagic

Cretaceous



Cephalopod

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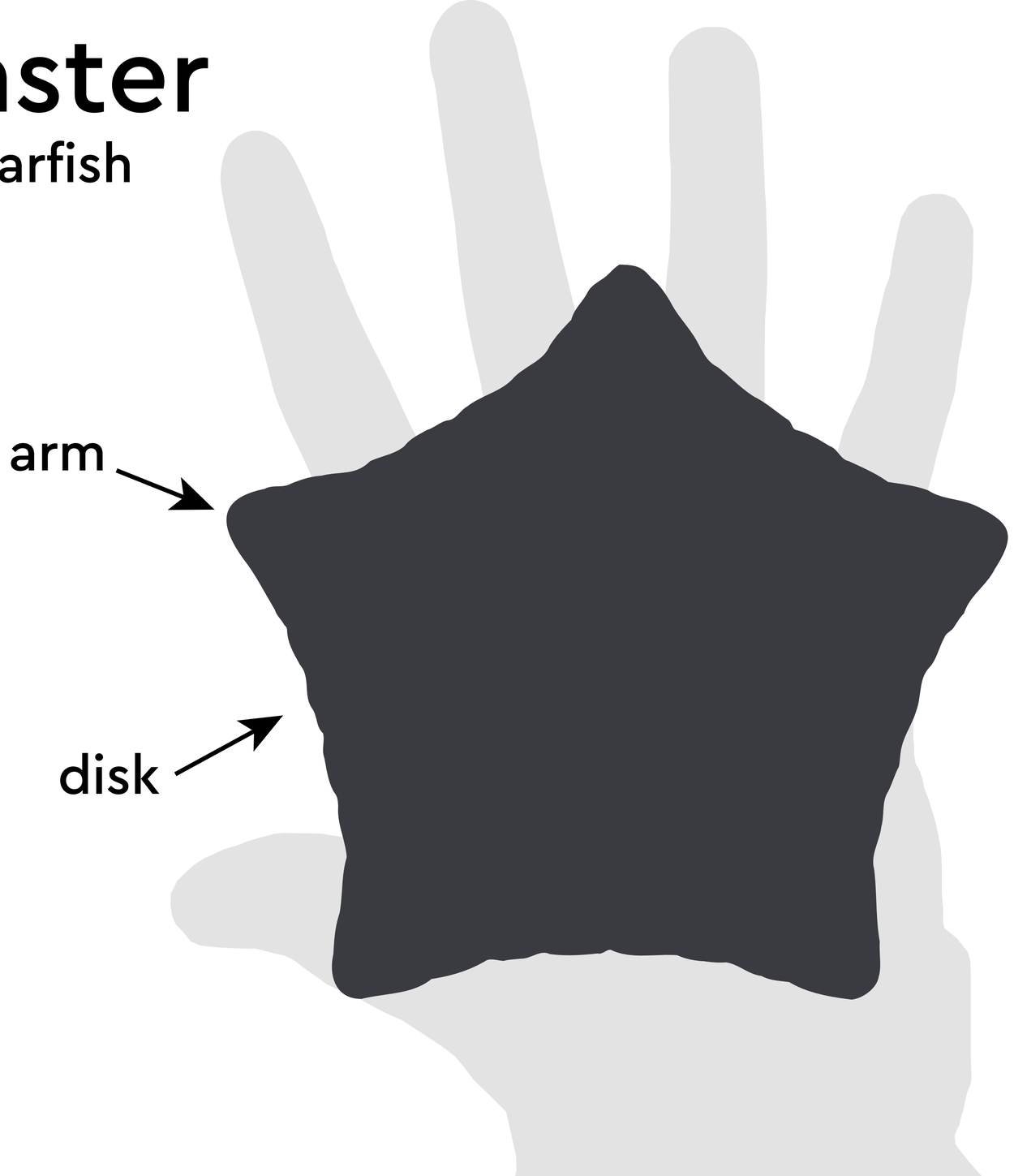
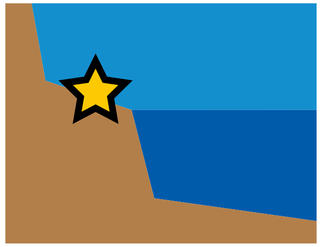
Oyenaster

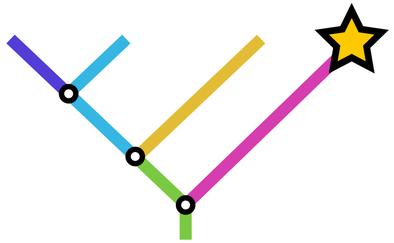
A tropical starfish





shallow benthic

Paleogene



Echinoderm

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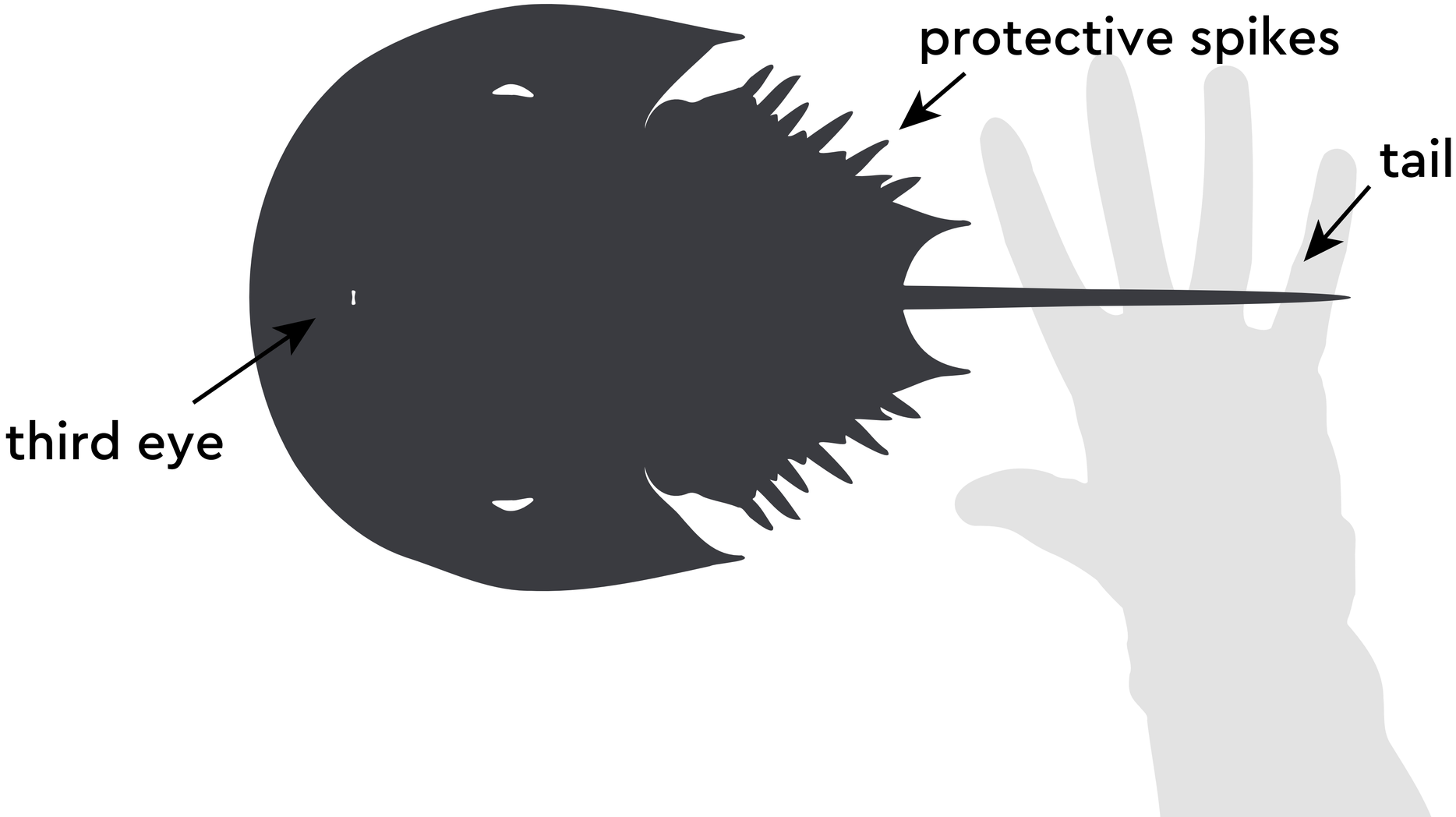
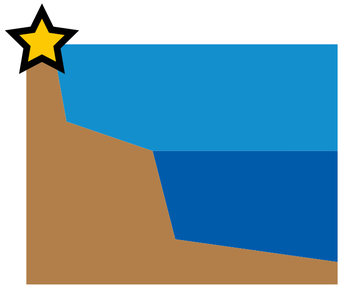
Limulus

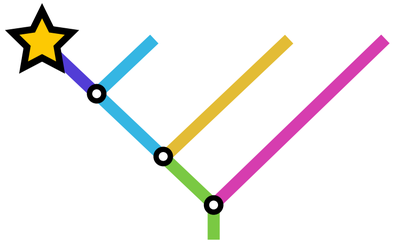
The eternal horseshoe crab





littoral

Quaternary



Arachnid

Sources and Disclaimers

M. C. Brennan

In general

- The following instances of artistic license indicate only where I have knowingly deviated from my source materials.
- The subdivisions shown in the "context diagrams" (e.g., specific habitats and their names) are arbitrary.
- Ecdysozoa is a parent taxon of Arthropoda, even though the diagram kind of makes it look like an out-group.
- The size of the Quaternary Period has been expanded for visibility.
- I have referred to their animals by their genus only. This is most questionable where genus members are known to differ widely in size.
- Several animals are depicted slightly larger than individuals known from the fossil record.
- The interpretation of a "shallow" or "deep" habitat is equivocal in many cases.
- No effort has been made to use accurate anatomical terms.
- I have indicated the median ocelli on the arthropods as "third eye" even though there are two of them. I have not indicated any of the other simple eyes.
- Ammonite soft tissue anatomy is largely unknown. I have chosen to depict my ammonites with no hood, a protruding siphon, ten arms, no tentacles, and soulful, squid-like eyes.
- The higher-level taxon indicated in the phylogeny icon is based largely on which grouping would be most familiar.

Aegirocassis

Lerosey-Aubril, Rudy, and Stephen Pates. "New suspension-feeding radiodont suggests evolution of microplanktivory in Cambrian macronekton." Nature communications 9.1 (2018): 1-9.

Van Roy, Peter, Allison C. Daley, and Derek EG Briggs. "Anomalocaridid trunk limb homology revealed by a giant filter-feeder with paired flaps." Nature 522.7554 (2015): 77-80.

- The orientation, thickness, and quantity of the fibers on the feeding appendages have been fudged to make them comprehensible in lateral profile.
- The dorsal flaps are too curved.

Ancyloceras

Seilacher, A., and Michael Labarbera. "Ammonites as Cartesian Divers." PALAIOS, vol. 10, no. 6, 1995, pp. 493–506.

Kakabadzé, MIKHEIL V., and M. Z. Sharikadzé. "On the mode of life of heteromorph ammonites (heterocone, ancylocone, ptychocone)." Geobios 26 (1993): 209-215.

Arkhipkin, Alexander I. "Getting hooked: the role of a U-shaped body chamber in the shell of adult heteromorph ammonites." Journal of Molluscan Studies 80.4 (2014): 354-364.

- I have assumed a largely planktonic animal which practices suspension feeding with its arms facing upwards. For this reason, I have made the arms proportionally longer and thinner than Parapuzosia.

Anomalocaris

Daley, Allison C., and Gregory D. Edgecombe. "Morphology of Anomalocaris canadensis from the Burgess ShaleMorphology of Anomalocaris canadensis." Journal of Paleontology 88.1 (2014): 68-91.

Whittington, Harry Blackmore, and Derek Ernest Gilmor Briggs. "The largest Cambrian animal, Anomalocaris, Burgess Shale, British-Columbia." Philosophical Transactions of the Royal Society of London.

- The protuberances on the frontal appendages stick out too far laterally.

Charnia

Dunn, Frances S., et al. "Anatomy of the Ediacaran rangeomorph Charnia masoni." Papers in palaeontology 5.1 (2019): 157-176.

- Charnia may not belong in Nephrozoa.
- I have made the holdfast more bulbous to distinguish it from the frond.

Homo

- The individual depicted is a modern Homo sapiens of approximately average adult height. He is wearing sweatpants and slippers.
- The earliest members of genus Homo may predate the Quaternary.

Isotelus

Rudkin, David M., et al. "The world's biggest trilobite—Isotelus rex new species from the Upper Ordovician of northern Manitoba, Canada." Journal of Paleontology 77.1 (2003): 99-112.

https://www.trilobites.info/lgtrilos.htm

- The eyes are slightly too curved.

Kerygmachela

Park, Tae-Yoon S., et al. "Brain and eyes of Kerygmachela reveal protocerebral ancestry of the panarthropod head." Nature communications 9.1 (2018): 1-7.

Dzik, Jerzy. "The xenusian-to-anomalocaridid transition within the lobopodians." Boll Della Soc Paleontol Ital 50 (2011): 65-74.

- The eyes protrude too much from either side of the head.
- I have depicted the animal with a flexible telson rather than a pair of cercei.
- I have resisted the urge to break my "genus only" rule even though the species is named after Kierkegaard, despite that being really neat.
- Lobopodia is a paraphyletic grouping and therefore not a strictly correct phylogeny.

Limulus

Kin, Adrian, and Błażej Błażejowski. "The horseshoe crab of the genus Limulus: living fossil or stabilomorph?." PLoS One 9.10 (2014).

- I have identified this as a Quaternary animal, despite the fact that essentially unchanged horseshoe crabs have existed since the Ordovician.
- I have accepted Xiphosura as part of the arachnids, which is not universally accepted.

Sources and Disclaimers (continued)

Megarachne

Selden, Paul A., José A. Corronca, and Mario A. Hünicken. "The true identity of the supposed giant fossil spider Megarachne." Biology Letters 1.1 (2005): 44-48.

Oyenaster

Blake, Daniel B., and Roger W. Portell. "Implications for the study of fossil Asteroidea (Echinodermata) of new genera and species from the Eocene of Florida." Journal of Paleontology 83.4 (2009): 562-574.

https://commons.wikimedia.org/wiki/File:Apollonaster_kelleyi.jpg

- The silhouette is actually Apollonaster, an extant biscuit star of similar proportions.

Parapuzosia

Landman, Neil H., Kazushige Tanabe, and Richard Arnold Davis, eds. Ammonoid paleobiology. Vol. 13. Springer Science & Business Media, 2013.

Kennedy, William James, and Herbert Christian Klinger. Cretaceous Faunas from Zululand and Natal, South Africa: The Ammonite Superfamily Haploceratacea Zittel, 1884. South African Museum, 1979.

- I have assumed that any ribbing would not appear in the shell's silhouette.

Pentecopterus

Lamsdell, J.C., Briggs, D.E.G., Liu, H.P. et al. The oldest described eurypterid: a giant Middle Ordovician (Darriwilian) megalograptid from the Winneshiek Lagerstätte of Iowa. BMC Evol Biol 15, 169 (2015). https://doi.org/10.1186/s12862-015-0443-9

- Pentecopterus is, of course, the earliest known eurypterid, and not "first" in any evolutionary sense.

Pikaia

Morris, S.C. and Caron, J.-B. (2012), Pikaia gracilens Walcott, a stem-group chordate from the Middle Cambrian of British Columbia. Biological Reviews, 87: 480-512.

- Pikaia is probably not literally a direct ancestor of the vertebrates.
- I have slightly shortened and broadened the front of the animal to enhance the appearance of the appendages.

Seirocrinus

Hess, H. Balanocrinus (Crinoidea) from the Jurassic: species concept, reconstruction, ontogeny, taphonomy and ecology. Swiss J Palaeontol 133, 35–45 (2014).

Seilacher, A. Developmental transformations in Jurassic driftwood crinoids. Swiss J Palaeontol 130, 129–141 (2011).

Haude, R., and M. Jangoux. "Constructional morphology of the stems of Pentacrinitidae, and mode of life of Seirocrinus." Proceedings of the European Colloquium on Echinoderms, Brussels. AA Balkema, Rotterdam. 1980.

https://www.deviantart.com/ngzver/art/Shastasaurus-liangae-285371561

https://indiana9fossils.com/product/world-class-crinoid-seirocrinus-subangularis-4/

http://www.tolweb.org/Crinoidea/19232

https://www.thefossilstore.com/products/holzmaden-seirocrinus-subangularis-lily-1-8m

- The orientation, thickness, and quantity of the pinnules have been fudged to make them comprehensible in silhouette.

Walliserops

van Viersen, A. "De trilobiet Walliserops trifurcatus en zijn drietand." GEA 37.3 (2004): 97-98.

https://commons.wikimedia.org/wiki/File:Walliserops_trifurcatus,_Early_Devonian,_Timrhanrhart_Formation,_Jbel_Gara_el_Zguilma,_Draa_Valley,_Morocco_-_Houston_Museum_of_Natural_Science_-_DSC01584.JPG

- The silhouettes of the eyes do not account for obstruction by the occipital spines.
- There are too few thoracic spines, and by extension thoracic segments. Also, their main function may have been display rather than protection.
- The front of the cephalon is too bumpy.
- I'm not actually sure whether this individual is Walliserops trifurcatus, Walliserops tridens, or Walliserops hammii.

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