Project Summary: FHL Parasite Showcase
Mattingly Yoshie Morales
FHL 432 July 17, 2025

This project is a preliminary look into the biodiversity of San Juan's marine invertebrate parasite populations. Numerous organisms from across several different marine habitats around the island, and across the tree of life were cataloged for this project with the hopes of keying and genotyping them for further analysis in relation to species presence and diversity. By collecting, identifying, preserving, and photographing marine invertebrate parasites, I hope to contribute to the knowledge base of parasite species diversity in the San Juans, in addition to showcasing the ecological and morphological wonders of parasitic taxa in the marine world.

During my time at Friday Harbor Labs, I was fortunate enough to have collected a variety of parasites from a variety of environments and hosts over the course of this five-week period. My general procedure for compiling a collection of parasite photographs and specimens was as follows: I first collected and identified the host species, and used the host's identity and the morphology of the parasite to figure out a taxonomic starting point for identifying the parasite, which was usually an ectoparasite, and therefore readily observable. I then photographed the host and parasite together, then either removed the parasite for separate preservation and photographed it individually, or preserved the host and the parasite together in ethanol, depending on what I intend on using the specimen for in the future, i.e., genetic sequencing versus CT scanning of physical structures. For my project presentation, I also compiled a morphological and life-history review of each parasite species of focus.

The parasites which I was able to obtain the most of were *Bopyroides hippolytes*, an ectoparasitic isopod of shrimp gill chambers, and *Sylon hippolytes*, an endoparasitic rhizocephalan barnacle of shrimps. *B. hippolytes* was found on three *Pandalus dispar* individuals, one *Heptacarpus sp.,* and one *Crangon nigromaculata*. A total of seven *B. hippolytes* were observed from all of the above shrimp; six were preserved in ethanol separately, and one was kept on its host (*Heptacarpus sp*.) for future CT scanning to analyze how the isopod connects to its host. *S. hippolytes* was found on five *Pandalus dispar* individuals, three of which were preserved with their single parasites in ethanol for future CT scanning to examine the root-like interna of the barnacle. the fourth *P. dispar* died, and by the time it was examined, its *S. hippolytes* had evacuated and also died, leaving behind a hard cuticle where its externa would have been. the fifth *P. dispar* died while being photographed (likely from stress) and was thusly dissected to remove the interna and externa of the barnacle, which was then preserved in an individual tube of ethanol.

I was able to collect a great deal of Platyhelminth worms across multiple taxa, including three different types of Cestodes: *Gyrocotyle spp*., a Trypanorhyncha sp., and a Tetrabothriidea sp., and one rhabdocoel: *Syndesimus franciscana*. The gyrocotyle were collected from three hydrolagus colliei specimens collected off a Kittiwake trawl. The intestines of the three chimera were removed and dissected to reveal seven worms: two adults from each intestine, plus an additional unusual worm from one of the three intestines. The *Gyrocotyle spp.* (*Gyrocotyle urna* and *Gyrocotyle fimbriata*) were

then photographed, preserved in formalin, with tissue samples taken to preserve in ethanol for future sequencing and genotyping. The individuals thought to belong to orders Trypanorhyncha and Tetrabothriidea were discovered while dissecting a *Onykia robusta* squid. These specimens were photographed and then preserved in ethanol for genotyping. The *S. franciscana* were discovered in a *Strongylocentrotus pallidus* sea urchin's intestine. These worms were incredibly plentiful in the individual, and were photographed before preserving approximately 20-30 in ethanol for future sequencing.

The second worm phylum I witnessed was Nematoda, where a classmate found a *Euphausia sp*. krill infected by an *Anisakis simplex*, which was subsequently removed, photographed, and preserved in ethanol for future sequencing. Another parasite that was collected from the O. robusta dissection was *Hochbergia* cf. *moroteuthenis*, which is a strange, unresolved, bright orange protist with a three-part "beak" that was observed in high abundance on the gills of the squid.

Not everything I found while on my parasite adventure was able to be identified, including a cyst full of mystery embryos on a flatfish (unknown species as of yet) fin spine, and several egg-like lumps on the rostrums of *Pandalus platyceros* shrimp (both of these host species were collected while on trawls). The embryos were preserved in paraformaldehyde and ethanol to do genetic testing, and the egg-like lumps were preserved in ethanol for the same purposes—I'm very eager to find out what they are.

Going forward I will be working in collaboration with other researchers, namely Dr. Gustav Paulay of the Florida Museum of Natural History and Dr. Rebecca Varney of the University of Nebraska, to genotype and sequence my specimens of note.

Works cited:

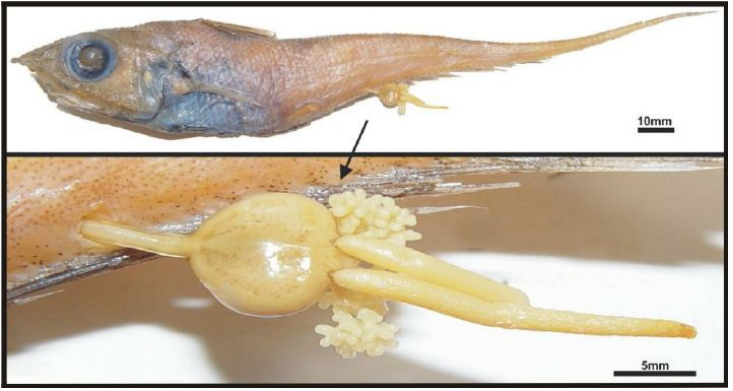
Xylander, Willi E. R., and Klaus Rohde. 2024. “Chapter 32: Gyrocotylidea (Order): The Most Primitive Group of Tapeworms [Concepts in Animal Parasitology].” *Concepts in Animal Parasitology*, ahead of print. https://doi.org/10.32873/unl.dc.ciap032.

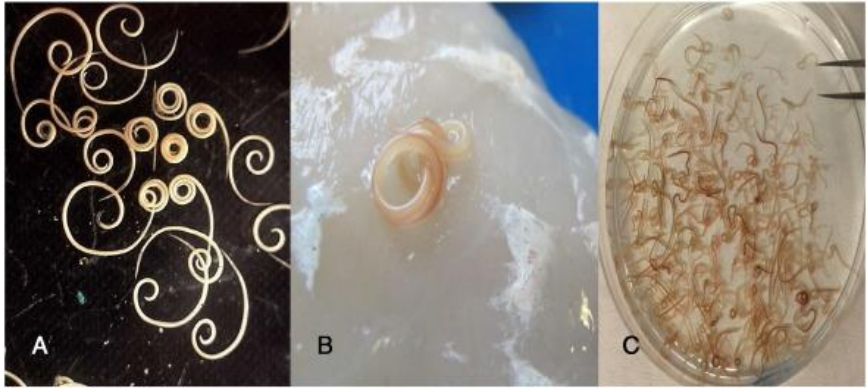
ResearchGate. n.d. “Systematics of the Eucestoda: Advances Toward a New Phylogenetic Paradigm and Observations on the Early Diversification of Tapeworms and Vertebrates.” Accessed July 17, 2025. https://www.researchgate.net/publication/51359362_Systematics_of_the_Eucestoda_Advances_Toward_a_New_Phylogenetic_Paradigm_and_Observations_on_the_Early_Diversification_of_Tapeworms_and_Vertebrates.

Bad Roommates: A San Juan Island Marine Parasite Showcase

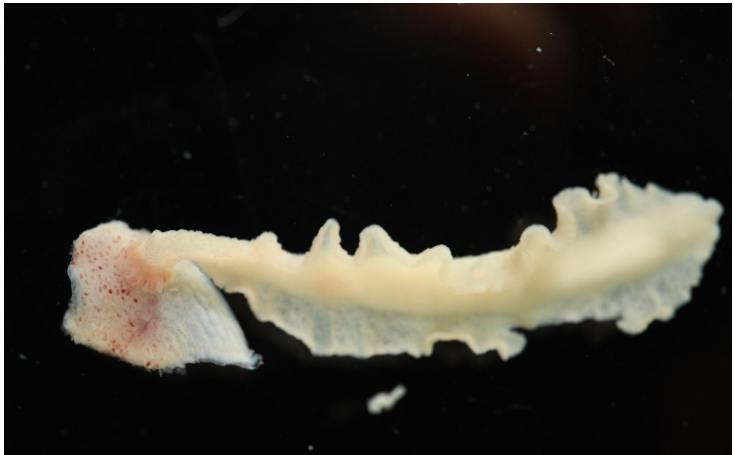
Mattingly Morales, FHL 432
July 17th, 2025

The Goal: Catalog Parasite Diversity by Collecting, IDing, Photographing, Preserving, and Eventually Genotyping Specimens

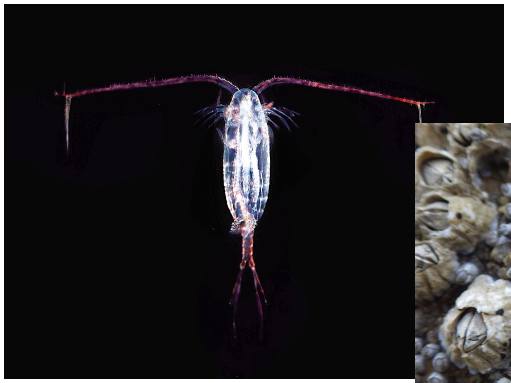


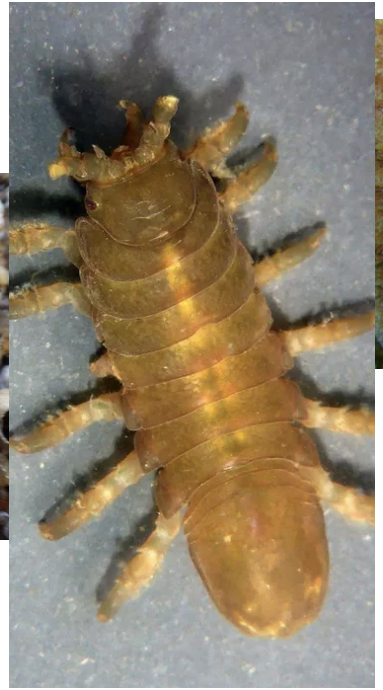


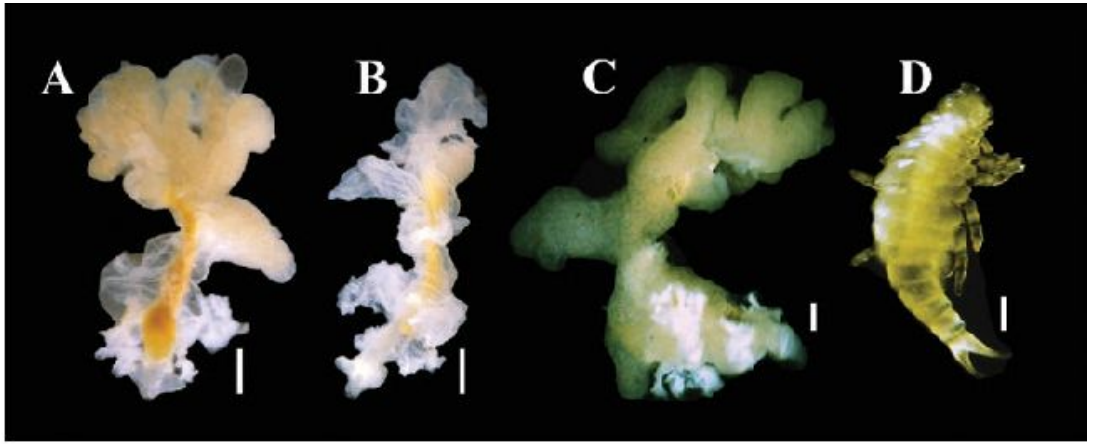
The bloodsucking, the castrating, the encysting... and so much more!



Parasite morphology is often extremely derived compared to closely related groups






A
B
C
D


a

Parasites I've (knowingly) encountered at FHL

- Mystery embryos
- Mystery eggs(?)
- Cestodes (two orders)
- A strange, "unresolved" protist
- Pink rhabdocoelans from a sea urchin stomach
- Bopyrid isopods
- Rhizocephalan barnacles
- Mud snail trematodes
- An anisakid nematode
- Cestodarians

Parasites I'll be covering in this presentation...

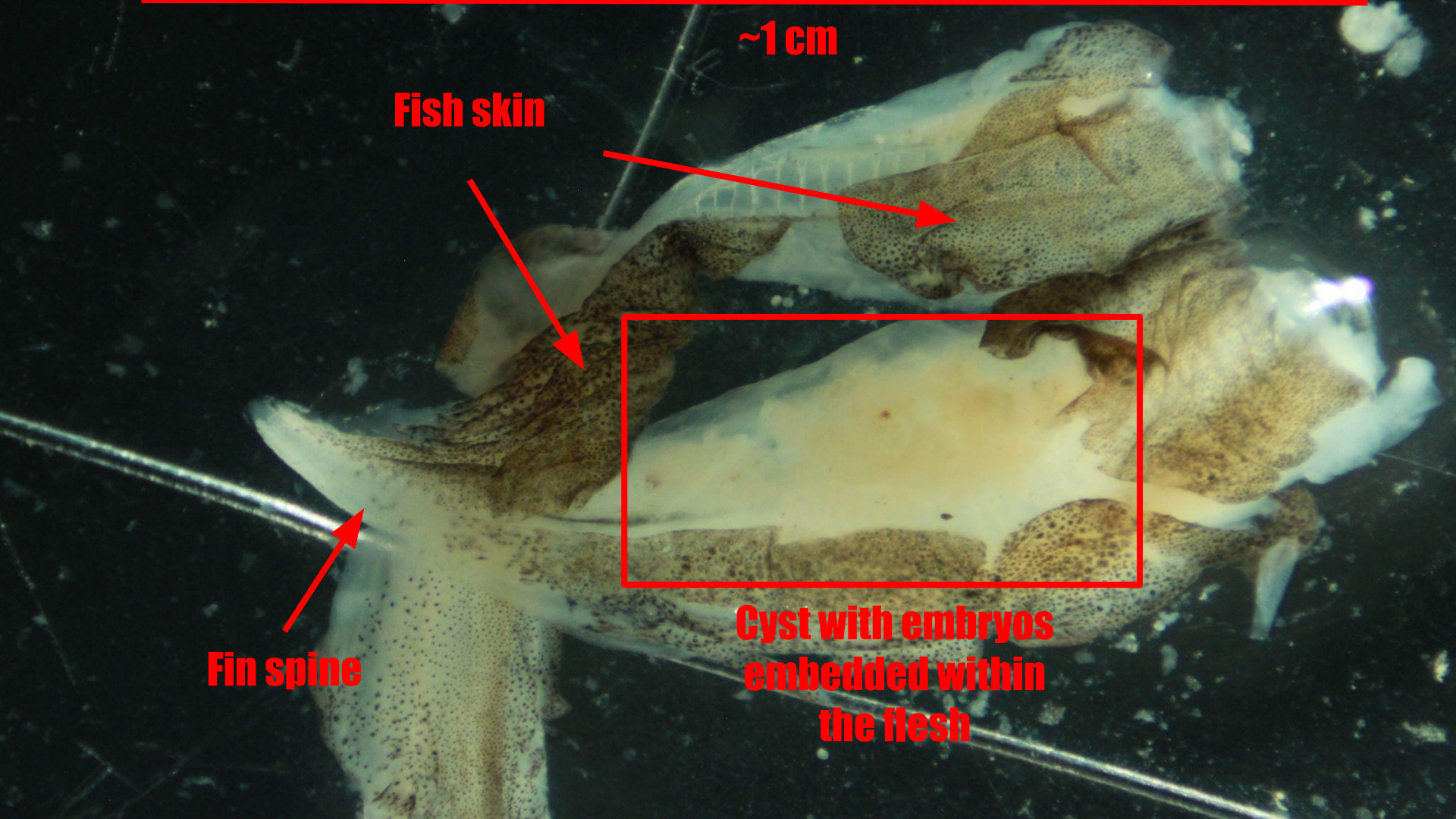
- Mystery embryos
- Cestodes
- Isopods
- Barnacles
- Cestodarians

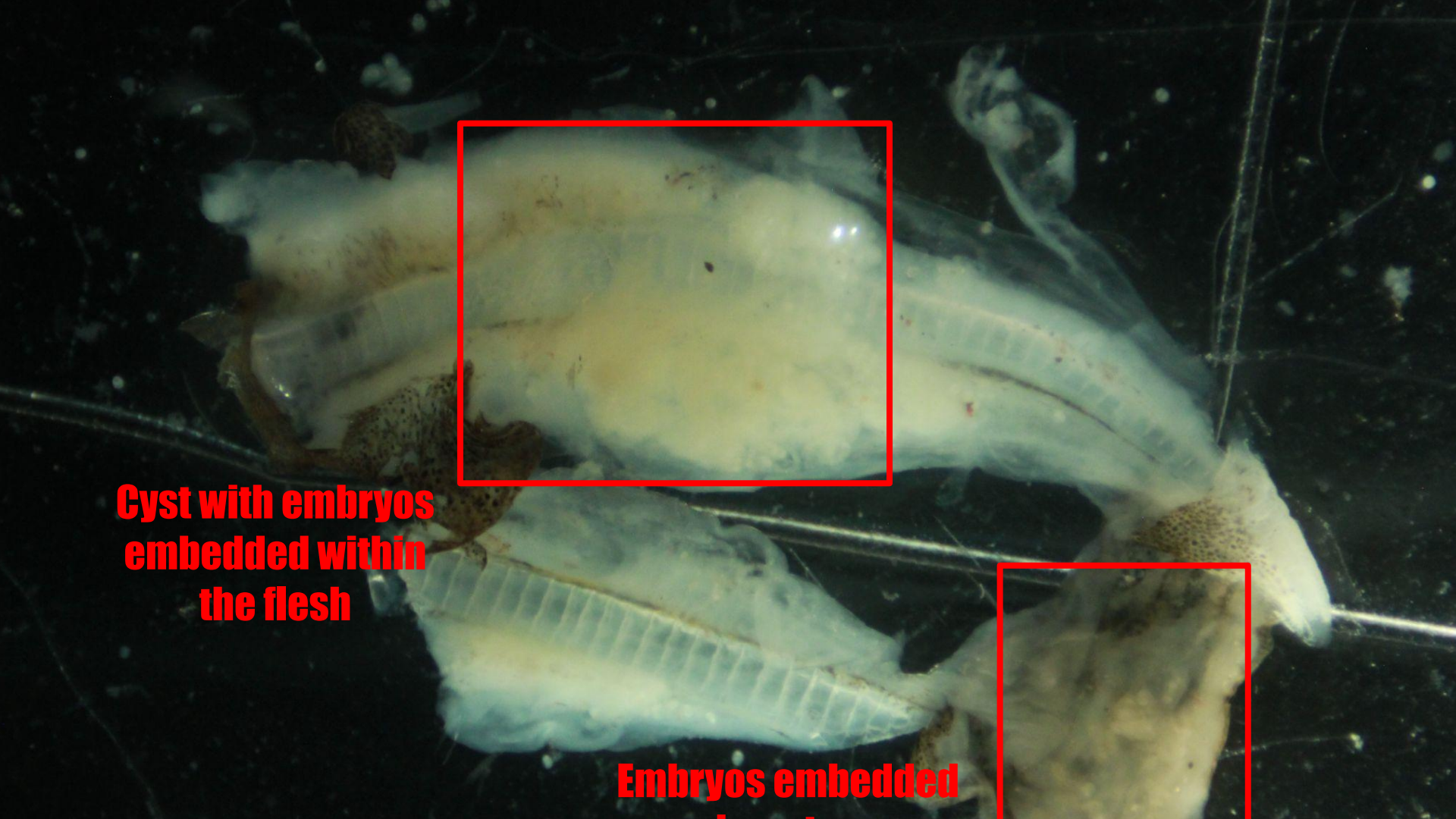
...Purely for the sake of time, and in accordance to invested effort— not for lack of intrigue!


Mystery Embryos

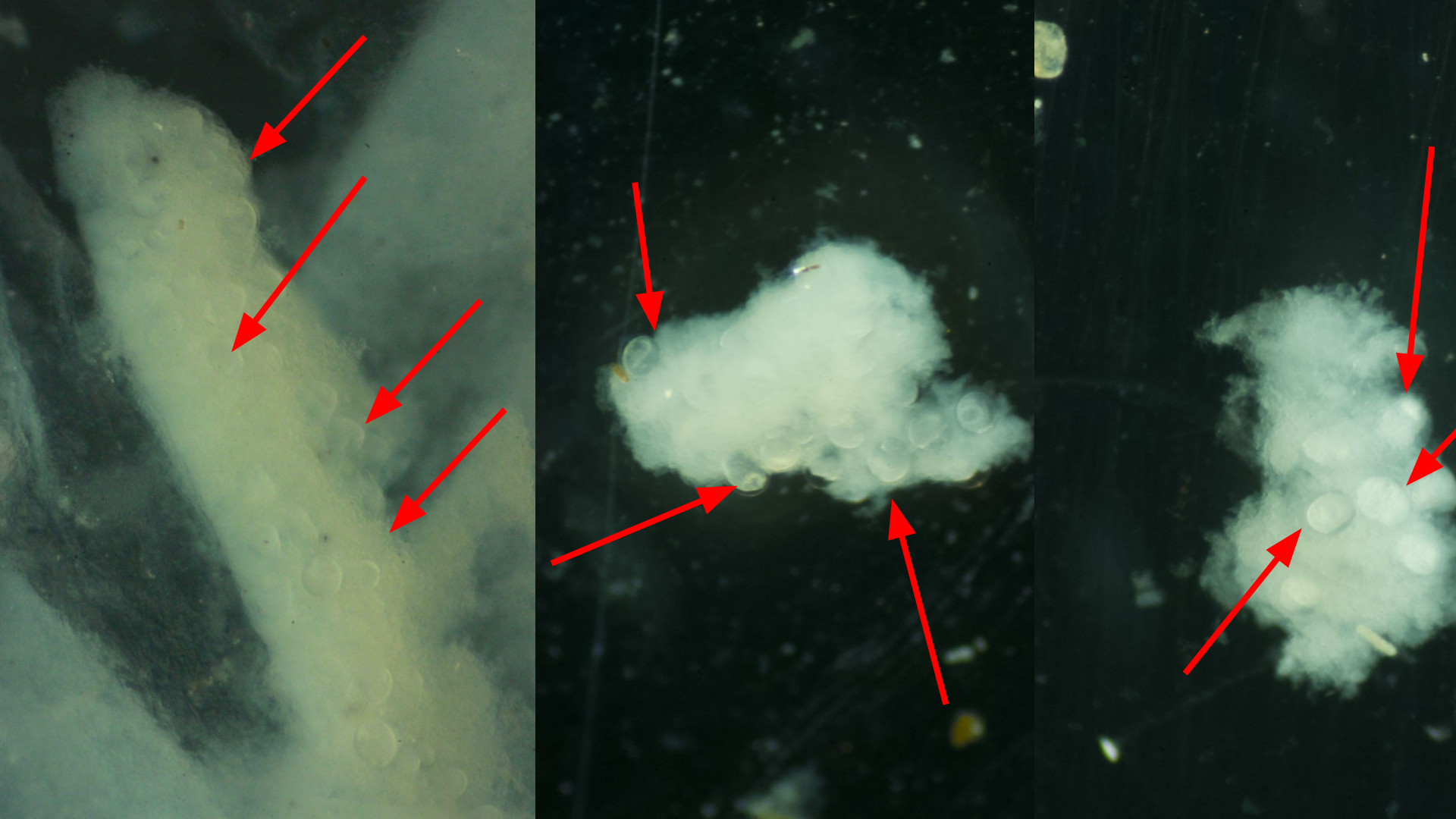
What could they be?

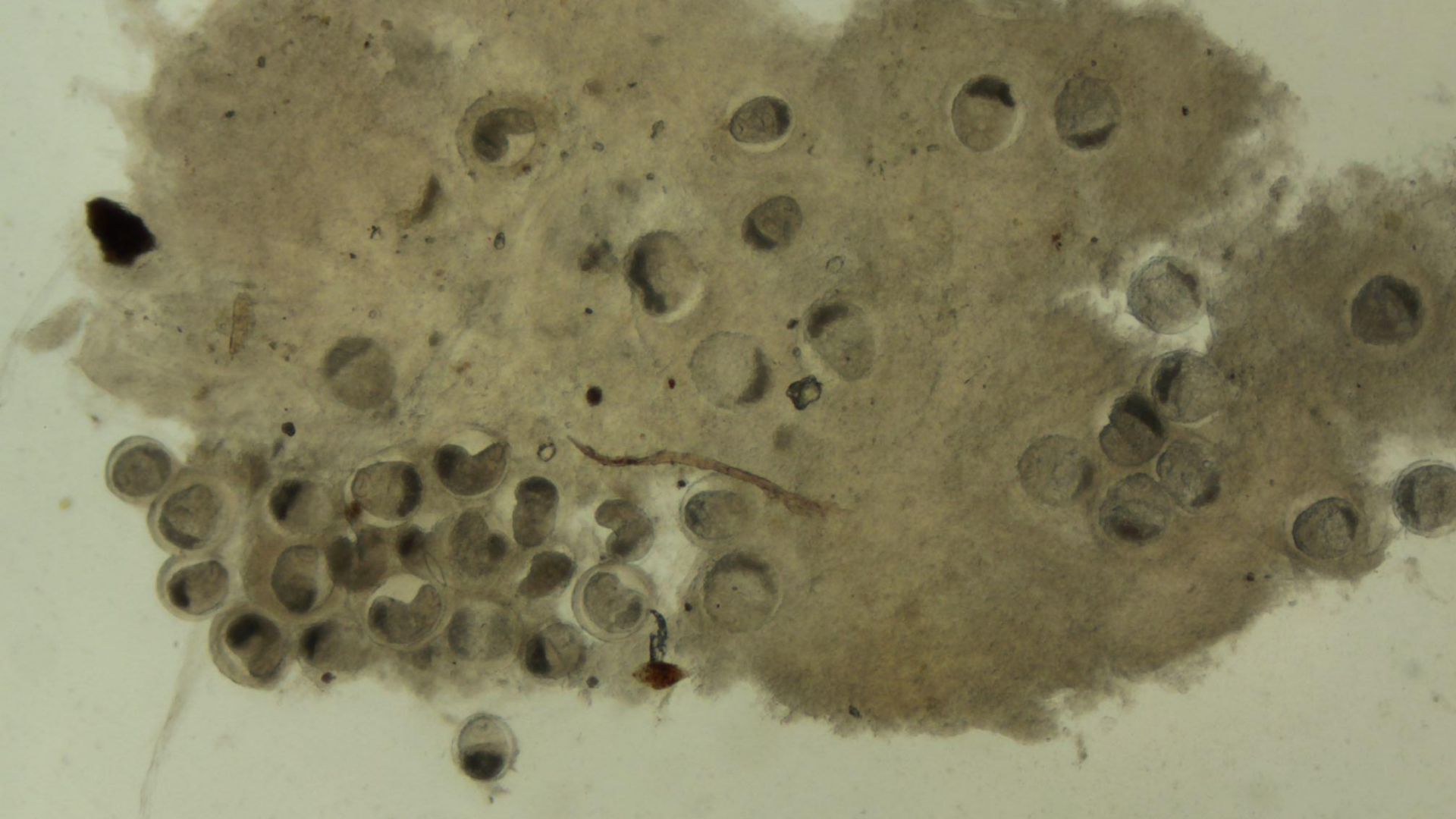
- 7/7/25 Kittiwake trawl yielded two brown flatfish (species unknown) with small cysts on their dorsal fins
- One fish was selected to take a fin clipping from; clipping contained one cyst
- **This is what I saw…**


~1 cm
Fish skin
Fin spine
Cyst with embryos
embedded within
the flesh

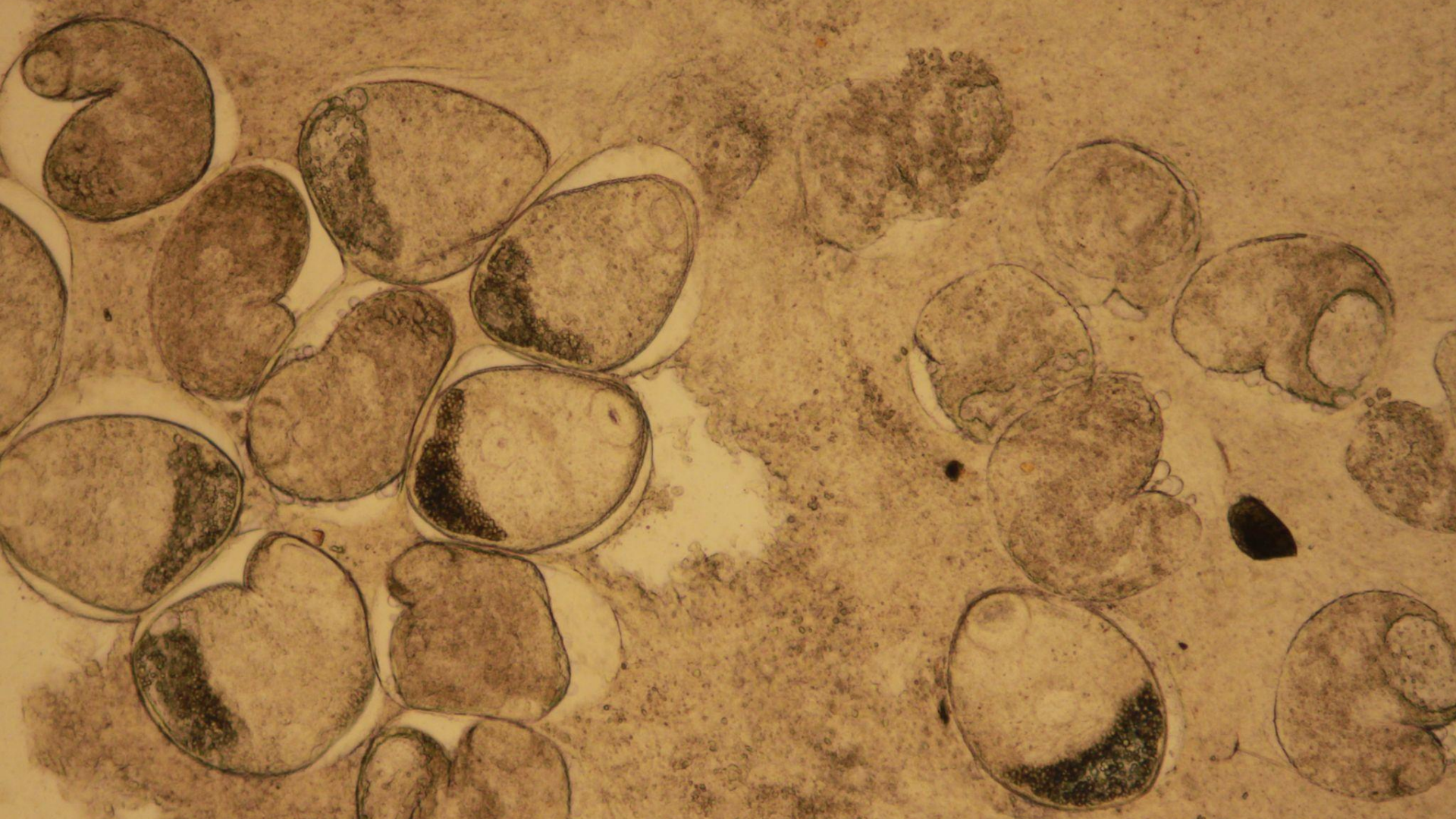

Cyst with embryos embedded within the flesh
Embryos embedded

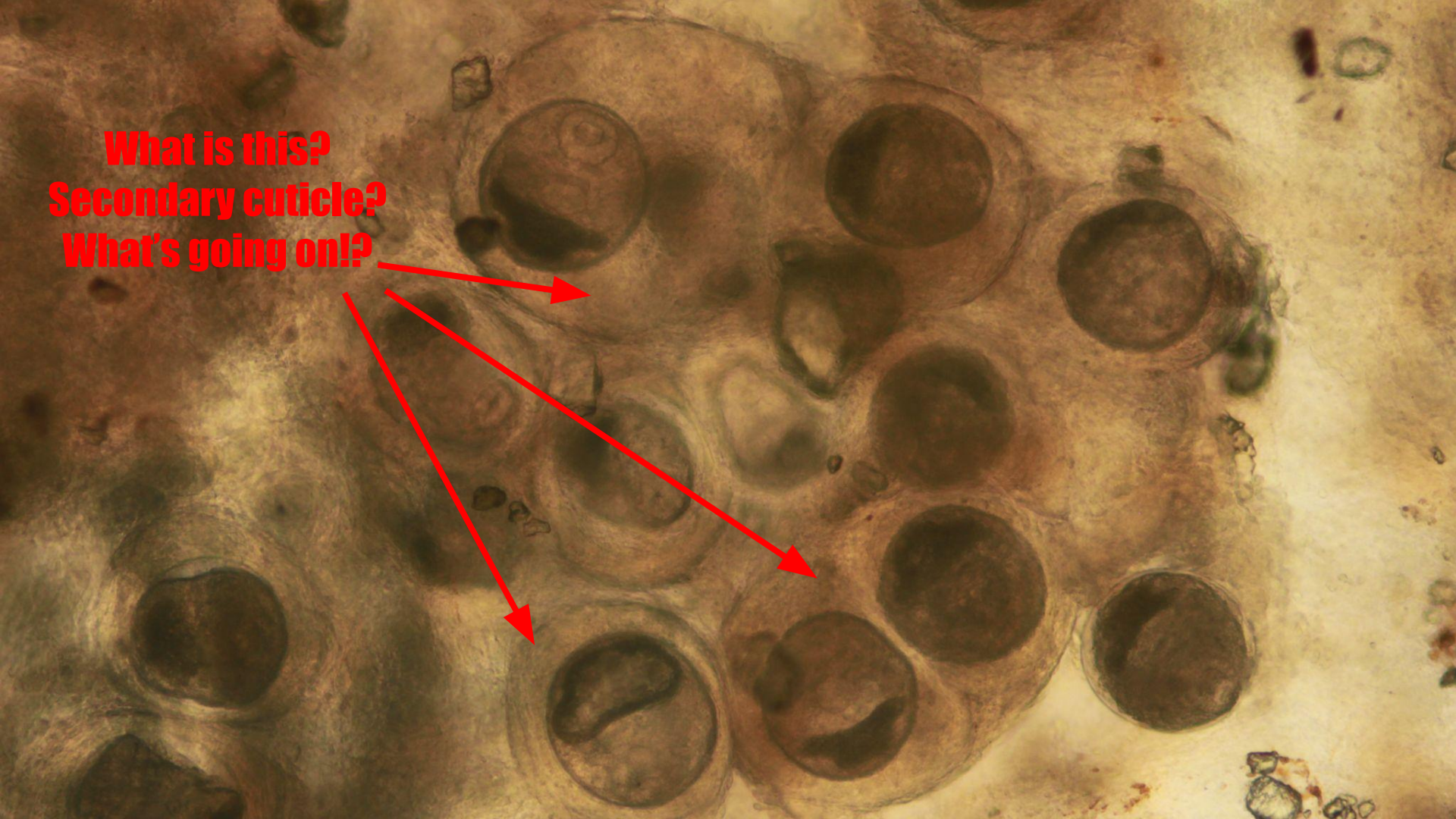

Embryos





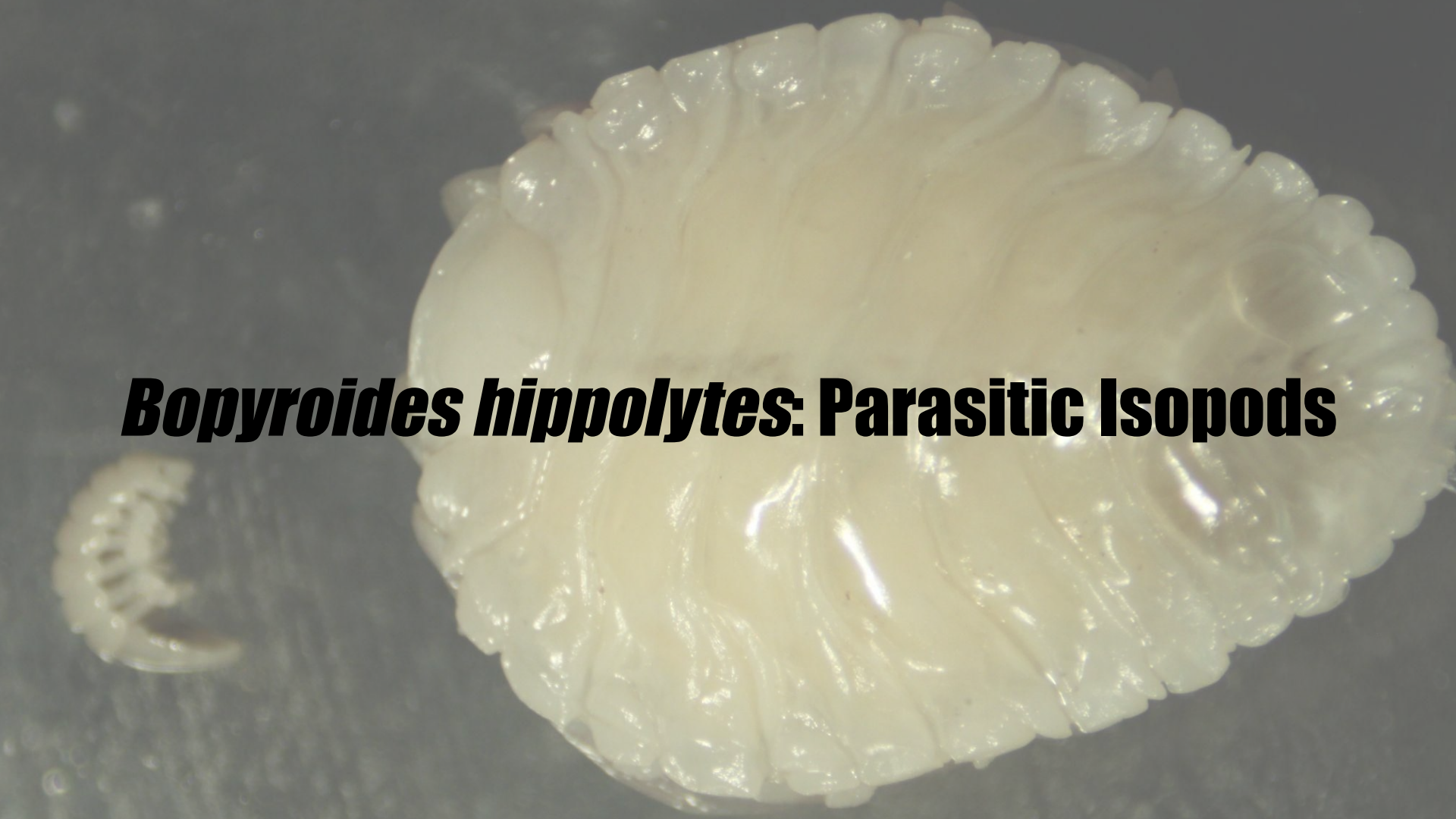

Mouth??




What is this?
Secondary cuticle?
What's going on!?

Seriously—what could they be?

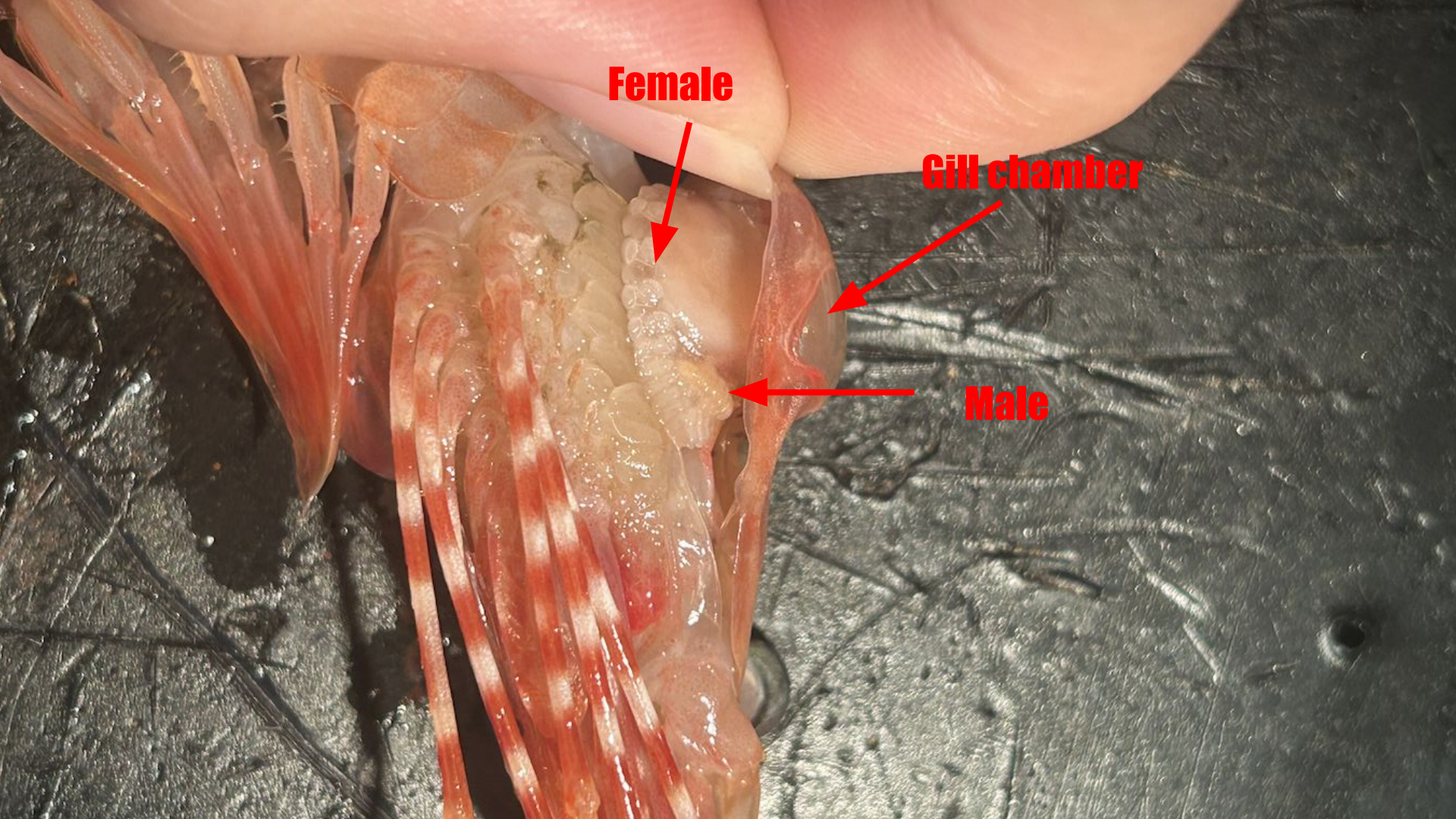
- Literature reviews yielded zero results for fleshy cysts on flatfish fins
- Original, immediate thought: trematodes… but…
- Three sample tubes prepared:
  - 95% ETH: fish tissue along with embryos
  - 95% ETH: just embryos
  - Paraformaldehyde: just embryos
- This is an open call to anybody who might know what these are, or can point me to someone who does

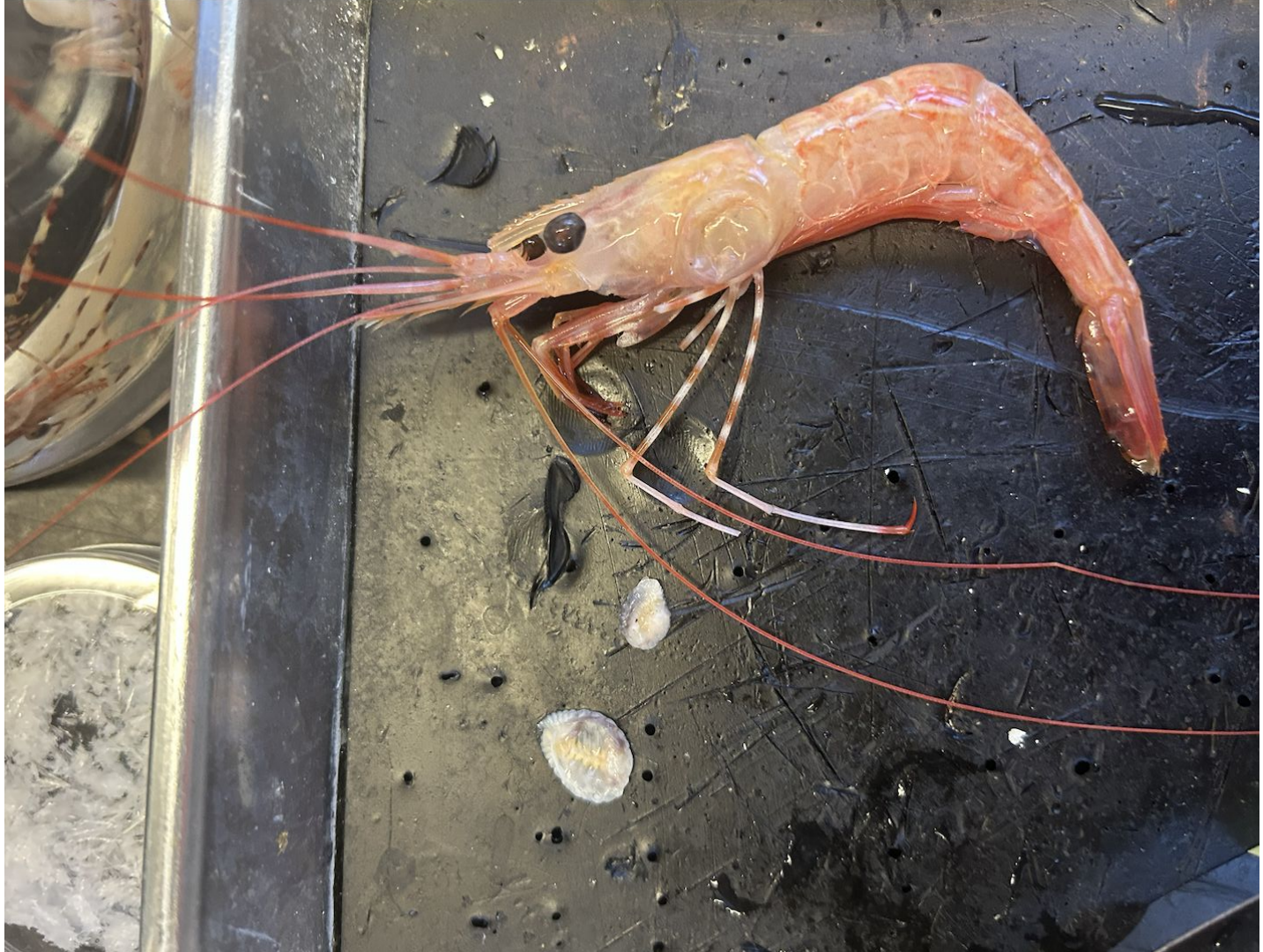


Bopyroides hippolytes: Parasitic Isopods

Bopyroides hippolytes: ectoparasites of Pandalidae and Hippolytidae shrimps

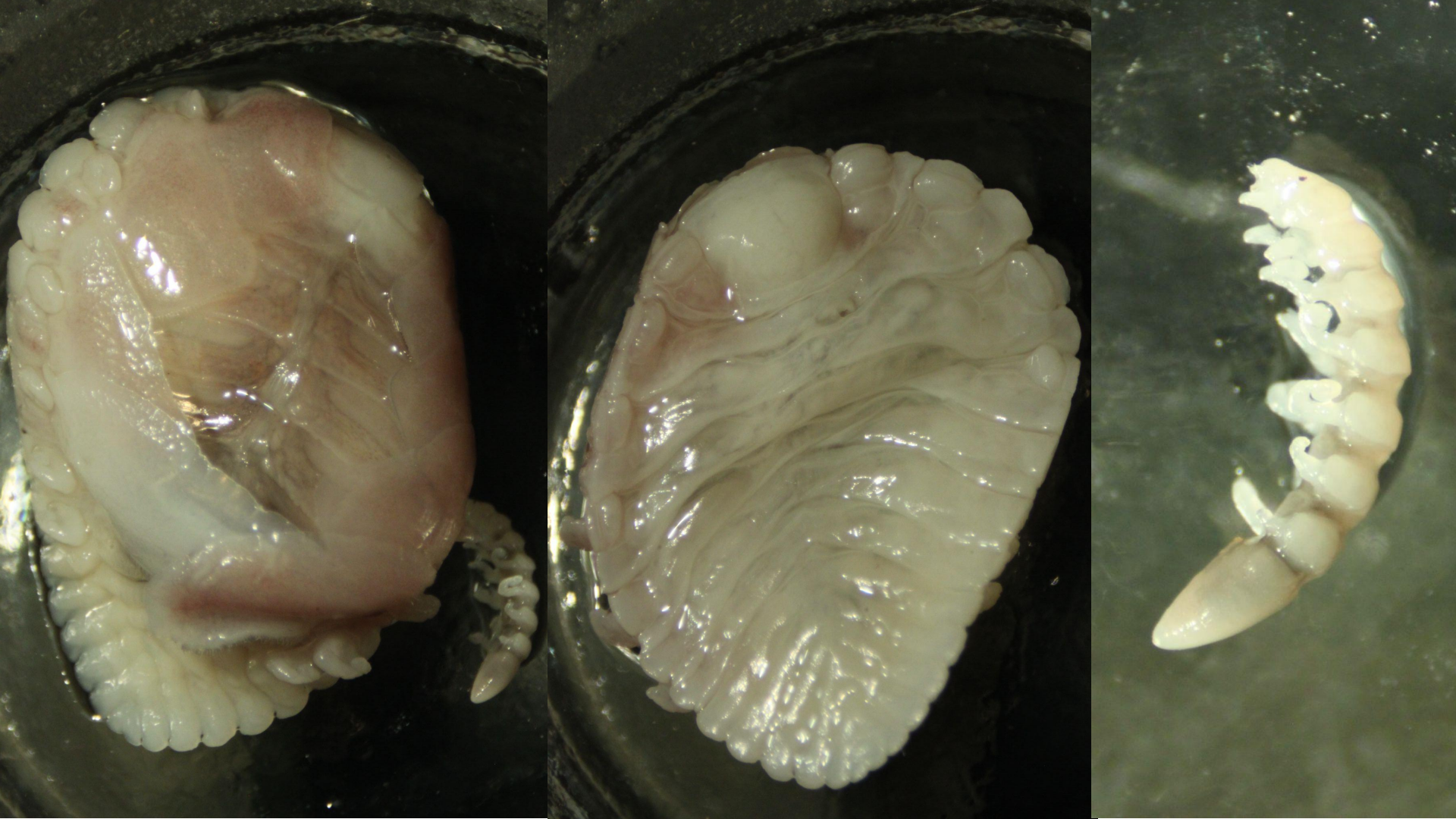
- Reside beneath carapace on top of gills
- Attach to gills via dorsal side
- Females ten times larger than males
- Eggs brooded into larvae in marsupium on the dorsal side
- Features highly derived: pleopods missing or reduced to lumps, no uropod
- Shrimp species collected and dissected: *Crangon nigromaculata* (1 specimen), *Pandalus dispar* (3 specimens), *Heptacarpus sp.*(1 specimen)
- Specimens photographed and fixed in ethanol
    - Seven specimens collected overall
- *Heptacarpus sp.* Parasite not removed—-preserved whole


Female
Gill chamber
Male




Ventral

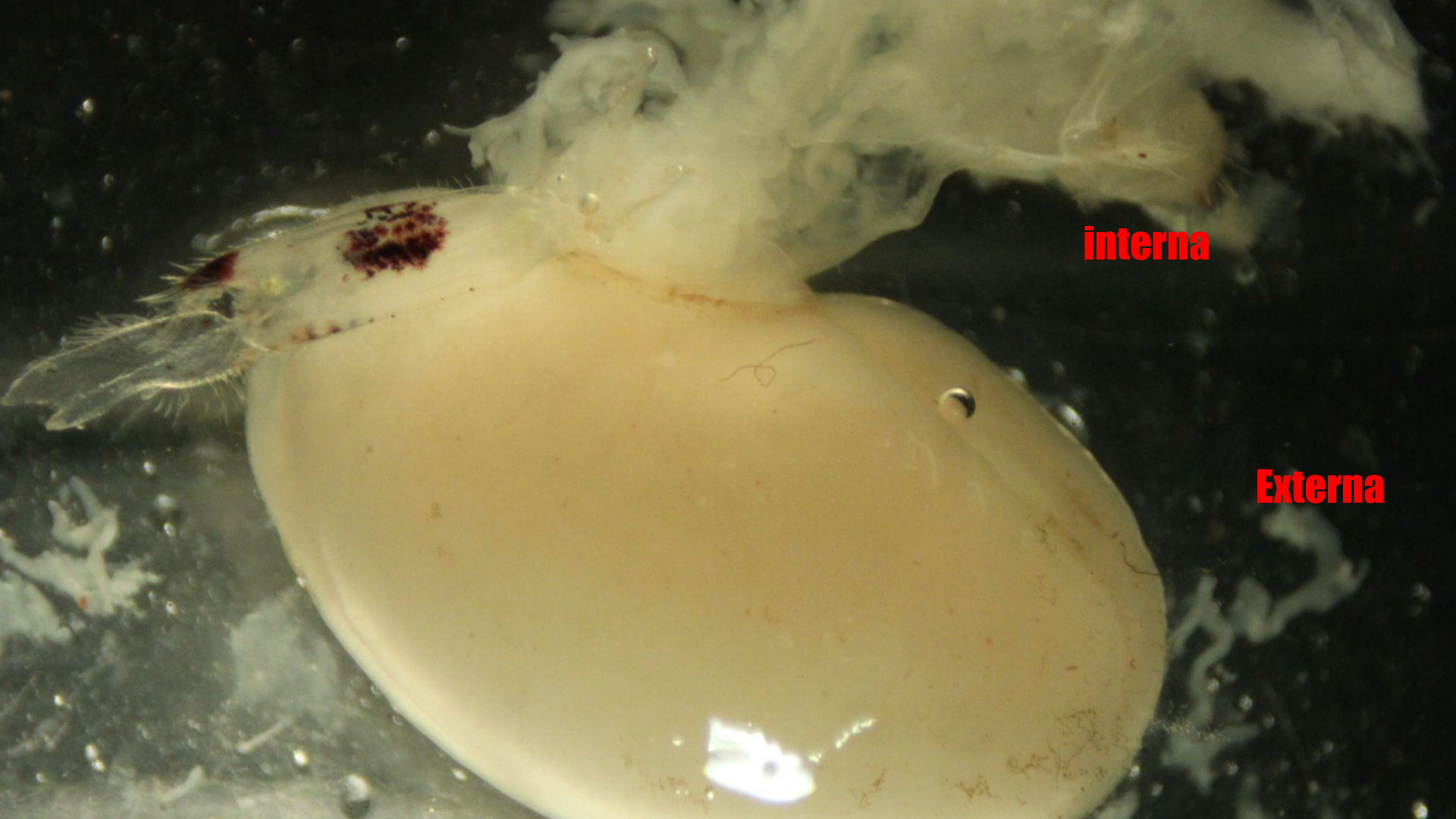

Dorsal

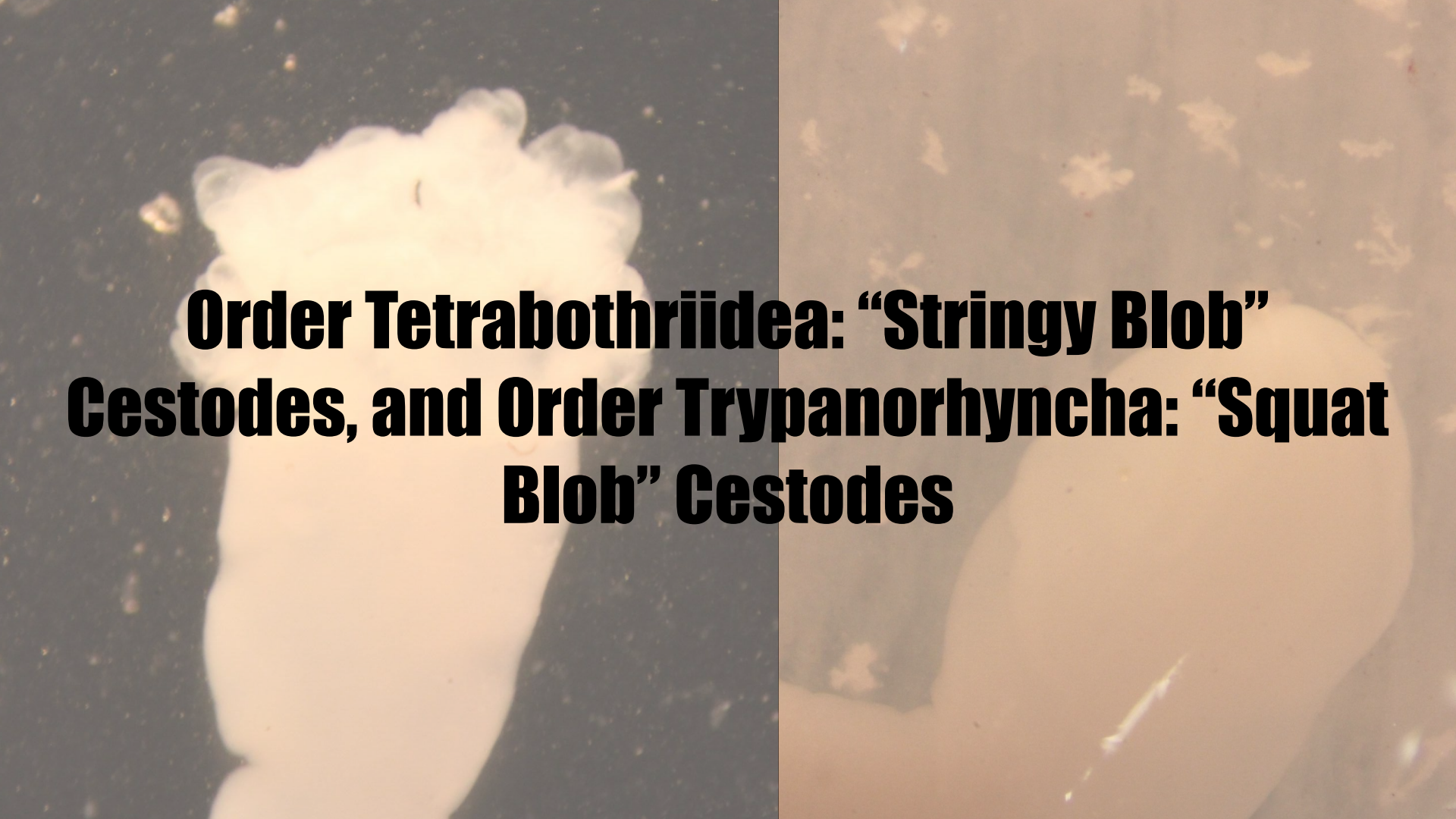


Sylon hippolytes: Rhizocephalan Barnacles

Sylon hippolytes: highly derived endoparasitic barnacle

- Two major anatomical components: interna and externa
- Interna = extensive root-like network, externa = blobby outside
- Externa situated by first pleopods, interna extends into viscera
- Visible organism = female; males inseminate females in planktonic form after female settles on host
    - Externa = reproductive organs
- Five *Pandalus* shrimp collected: three preserved whole, one dissected, one removed dissected after parasite death

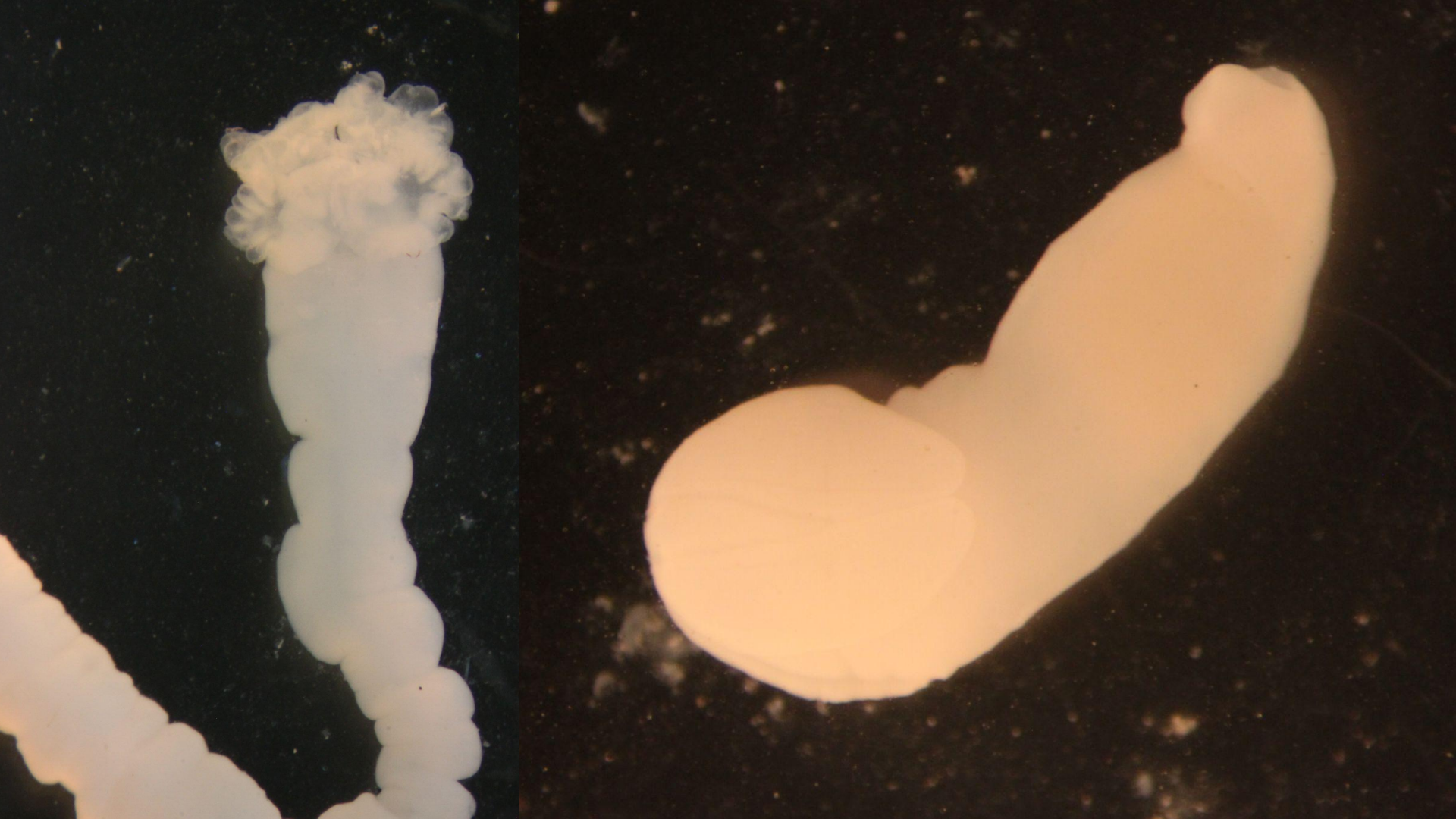

interna
Externa



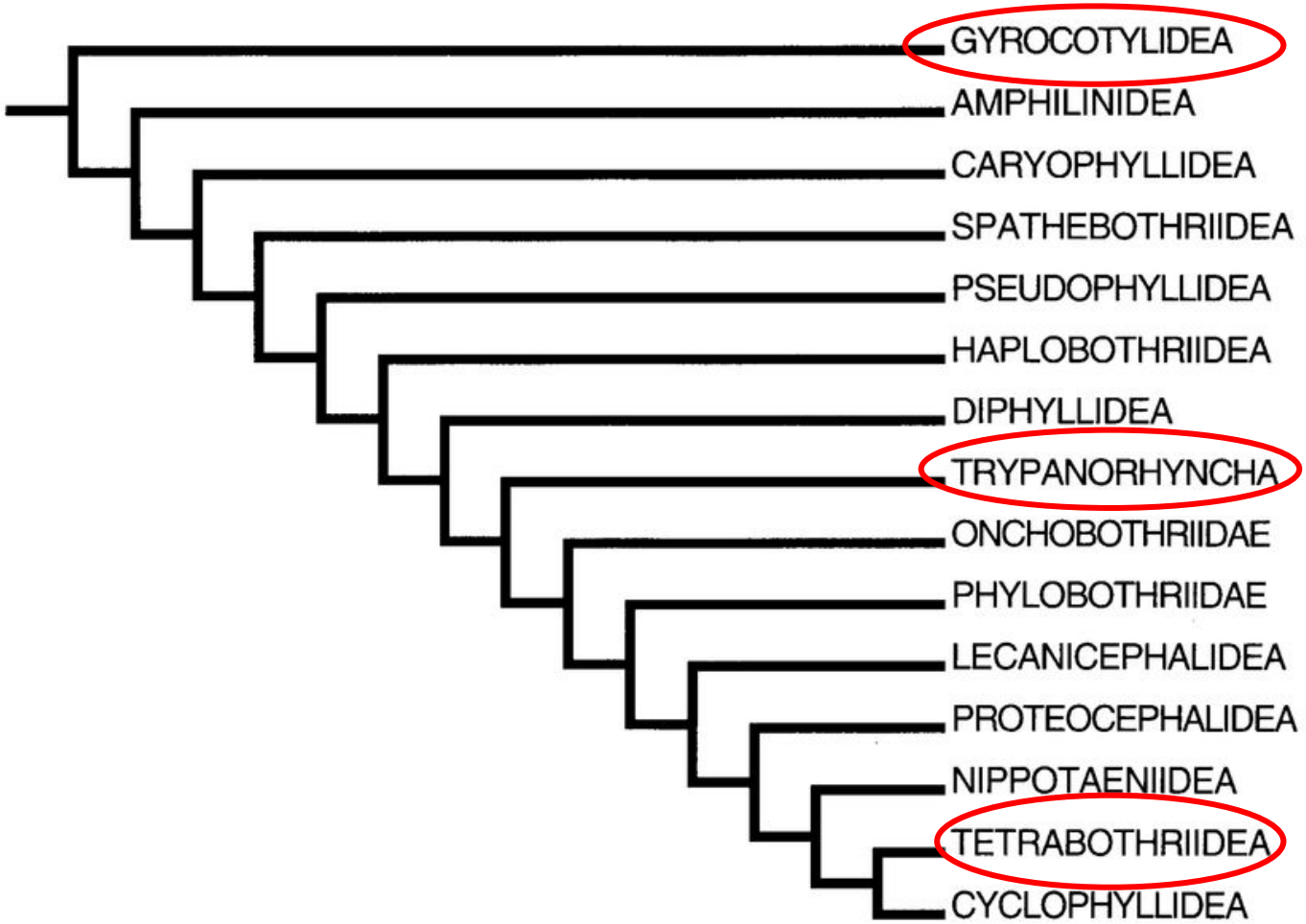
Order Tetrabothriidea: “Stringy Blob” Cestodes, and Order Trypanorhyncha: “Squat Blob” Cestodes

Onykia robusta squid dissection: Wormy Treasure Trove

- Upon dissecting the thawing specimen, which was collected (dead) in May 2025, a handful of “stringy blobs” (Tetrabothriidea) and “jellybean shaped blobs” (Trypanorhyncha)were observed floating in the viscera
- Specimens were collected, photographed, and preserved in ethanol



Gyrocotyle spp.: Cestodarians



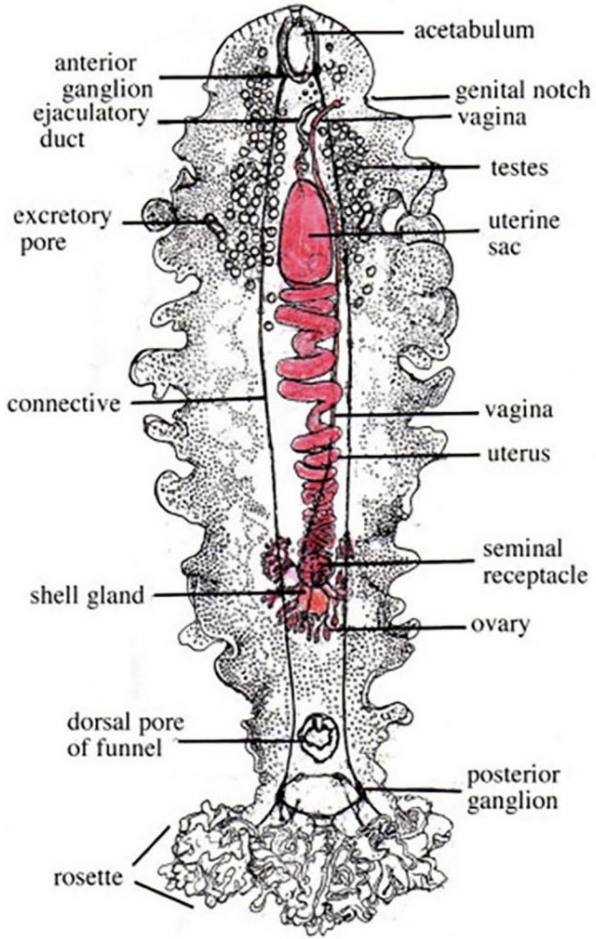
Hoberg, Eric & Gardner, Scott & Campbell, Ronald. (1999). Systematics of the Eucestoda: Advances Toward a New Phylogenetic Paradigm and Observations on the Early Diversification of Tapeworms and Vertebrates. Systematic parasitology. 42. 1-12. 10.1023/A:1006099009495.

Gyrocotyle cf. *urna* and *fimbriata*

- Phylum Platyhelminthes, Class Cestoidea, subclass Cestodaria—basal Cestodes
- Found in digestive tracts of chimaerids
- Maximum of two individuals in each host
    - Young hosts may harbor many individuals, but as the host ages, the number reduces due to intraspecific competition
- Unsegmented, with defined body ruffles and carnation-like rosette
- Attach to intestinal wall of host and absorb nutrients

Gyrocotyle general characters

- Approximately 3-4cm in length depending on species
- Possess ruffled rosette which attaches to intestinal wall
- Definitive hosts are chimaerid fishes, specifically *Hydrolagus colliei*
- Likely speculation: larvae require intermediate crustacean host
- Hermaphroditic, produce eggs which hatch into lycophora larvae
- *G. fimbriata* has more ruffles and a squatter body shape
- *G. urna* has less ruffles; more elongate
- Covered in little spines



doi:10.32873/unl.dc.ciap032 2024. In S. L. Gardner and S. A. Gardner, eds. Concepts in Animal Parasitology. Zea Books, Lincoln, Nebraska, United States.

Collecting *Gyrocotyle* hosts

- July 7th Kittiwake trawl
- Three *H. colliei* in poor condition were selected to dissect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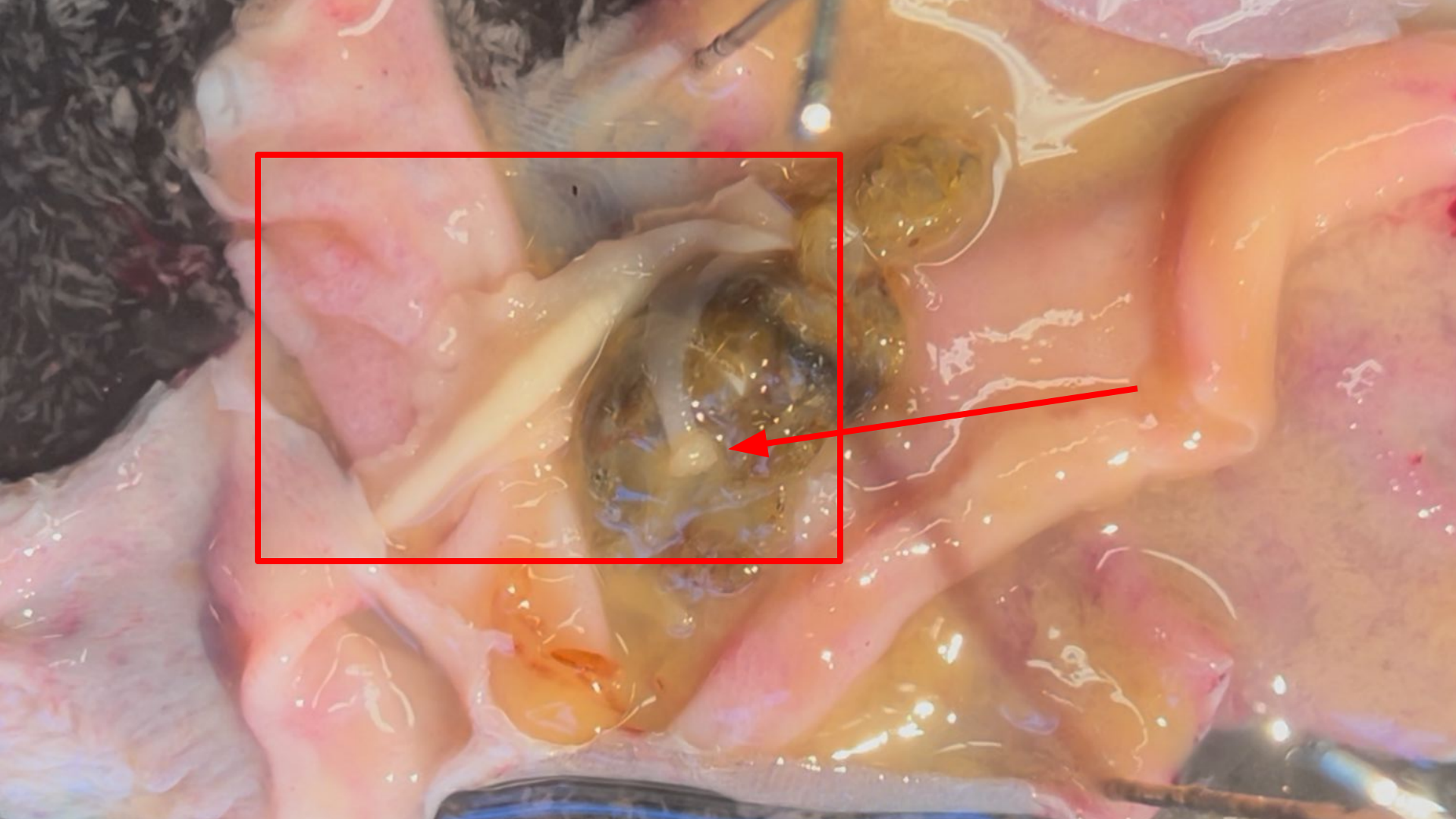
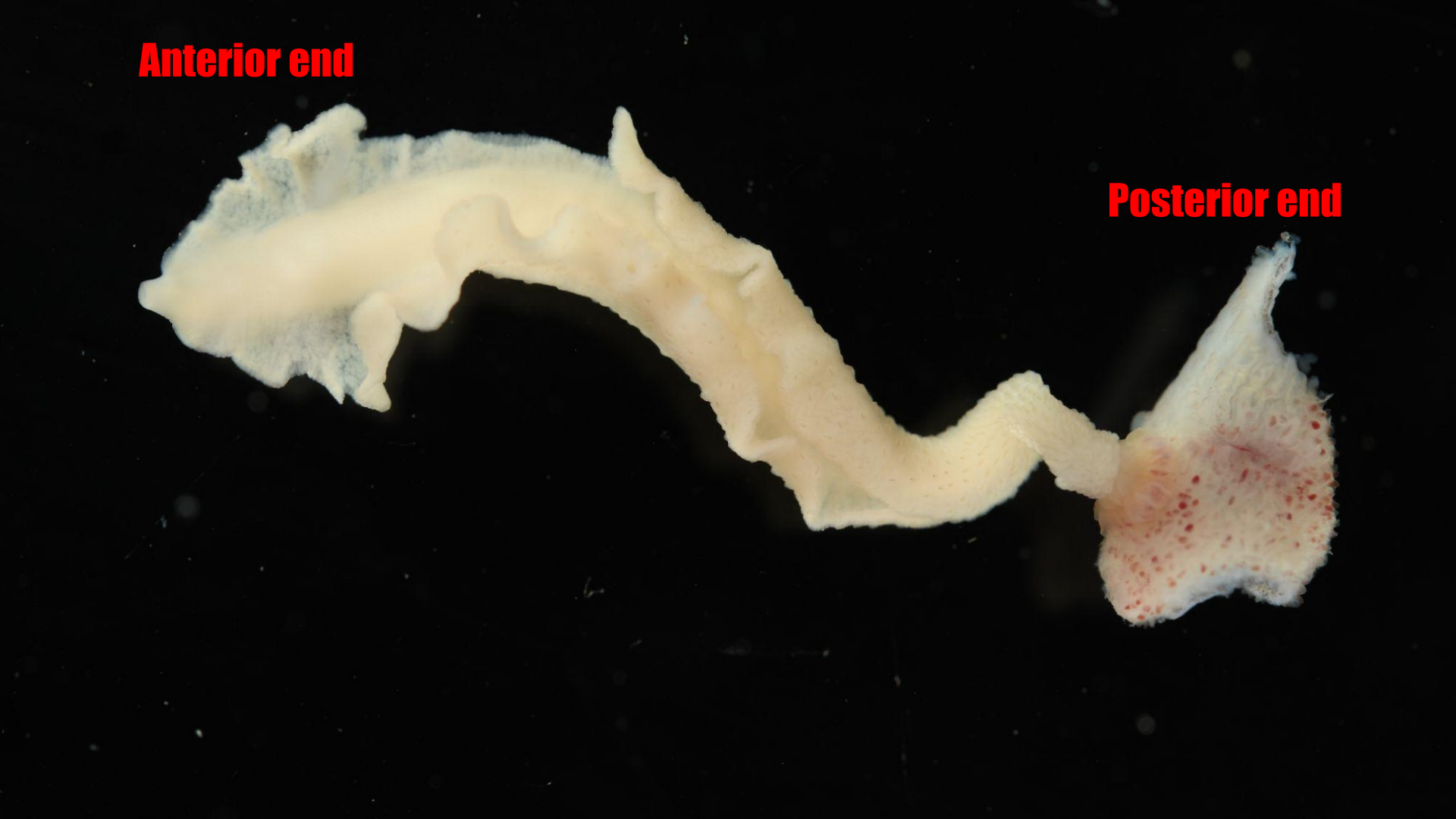
Collecting *Gyrocotyle*

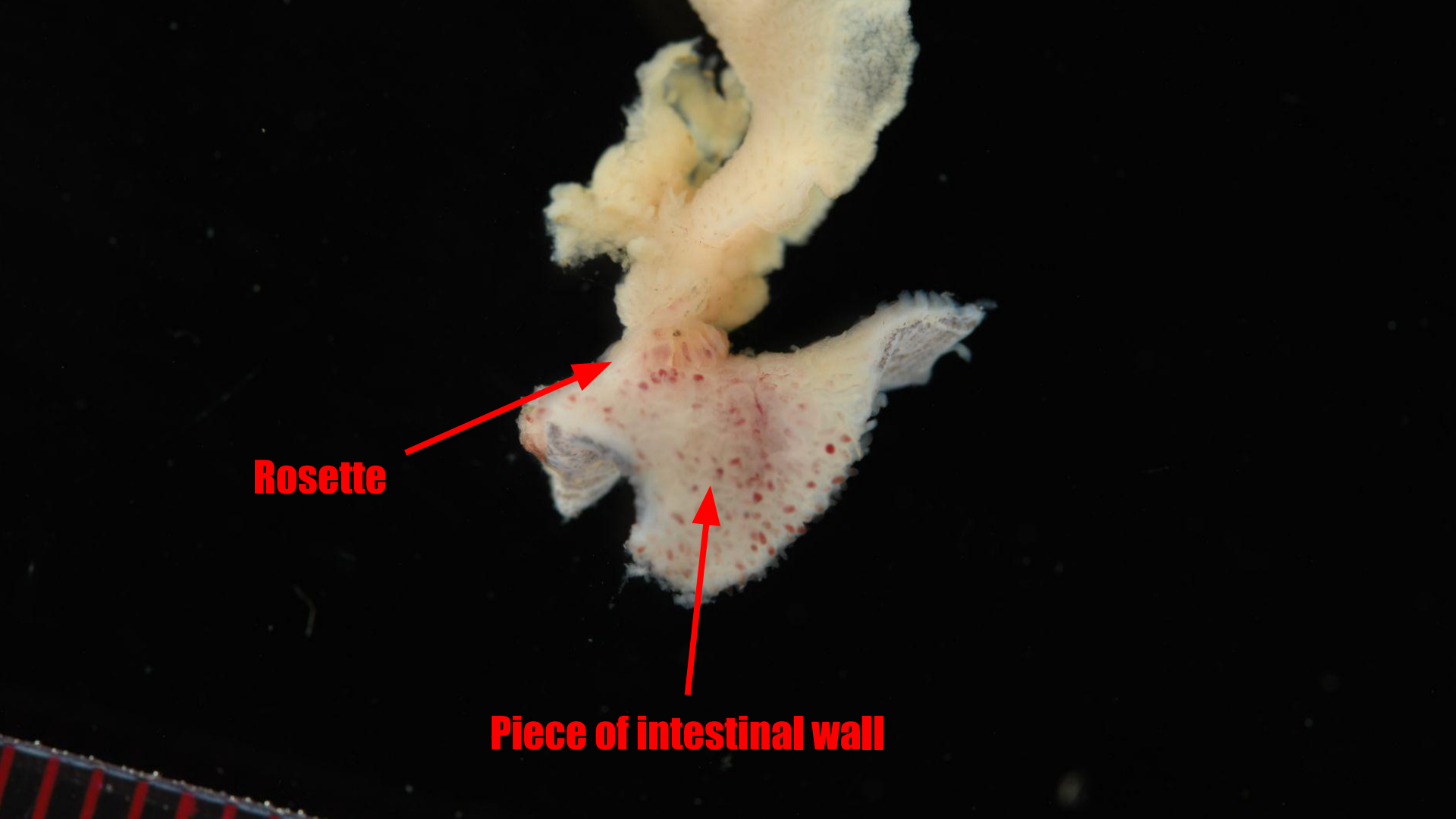
- Dissections were performed on the three H. colliei to remove intestinal tract
- Three intestinal tracts cut open to readily reveal Gyrocotyle
- Seven worms total were collected: two adults from each intestine
    - One of the hosts had two adults plus one with anomalous morphology

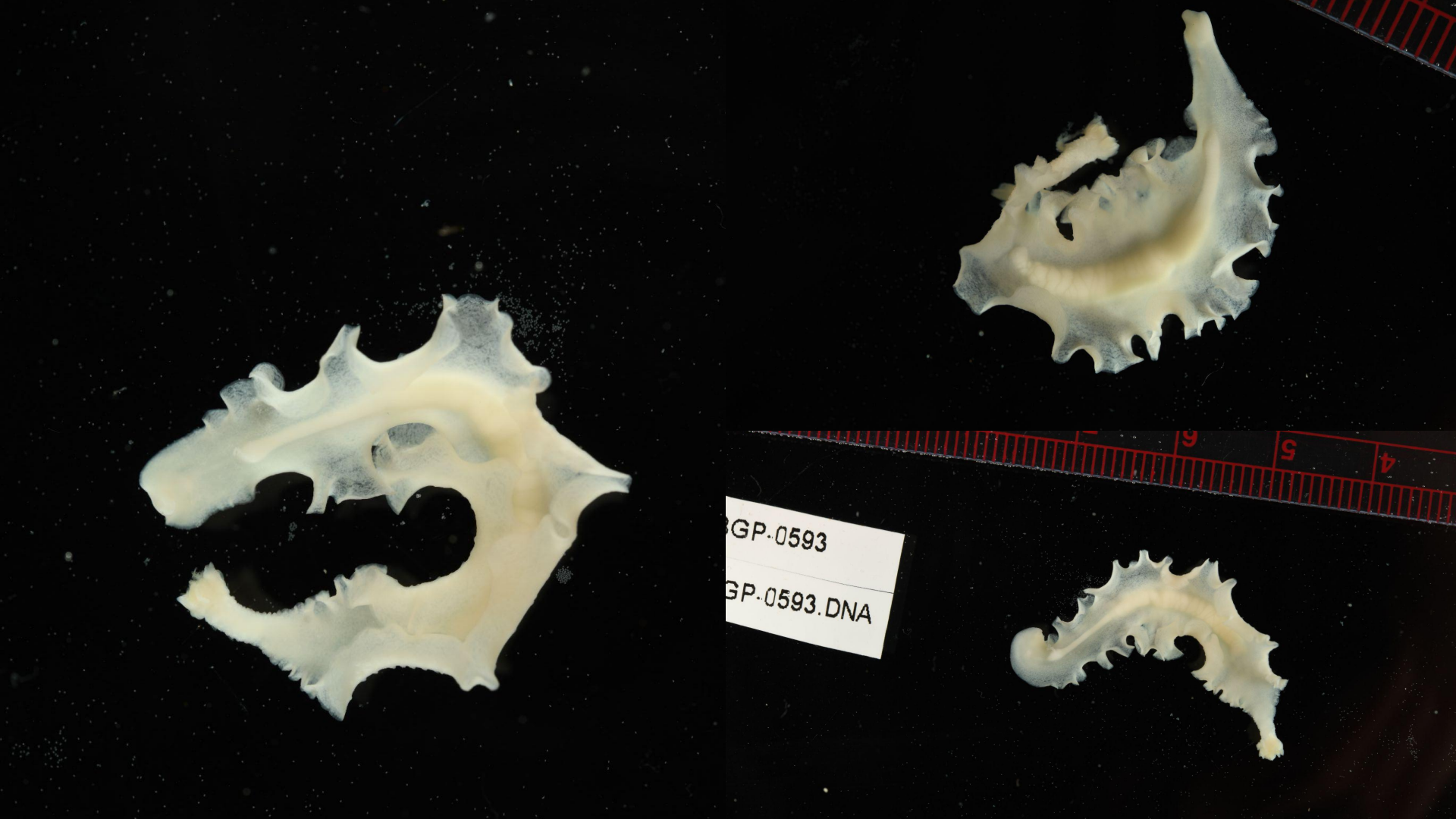


BGP.0594

BGP.0594.DNA


Anterior end
Posterior end


Rosette
Piece of intestinal wall


GP-0593
GP-0593.DNA

BGP.0595

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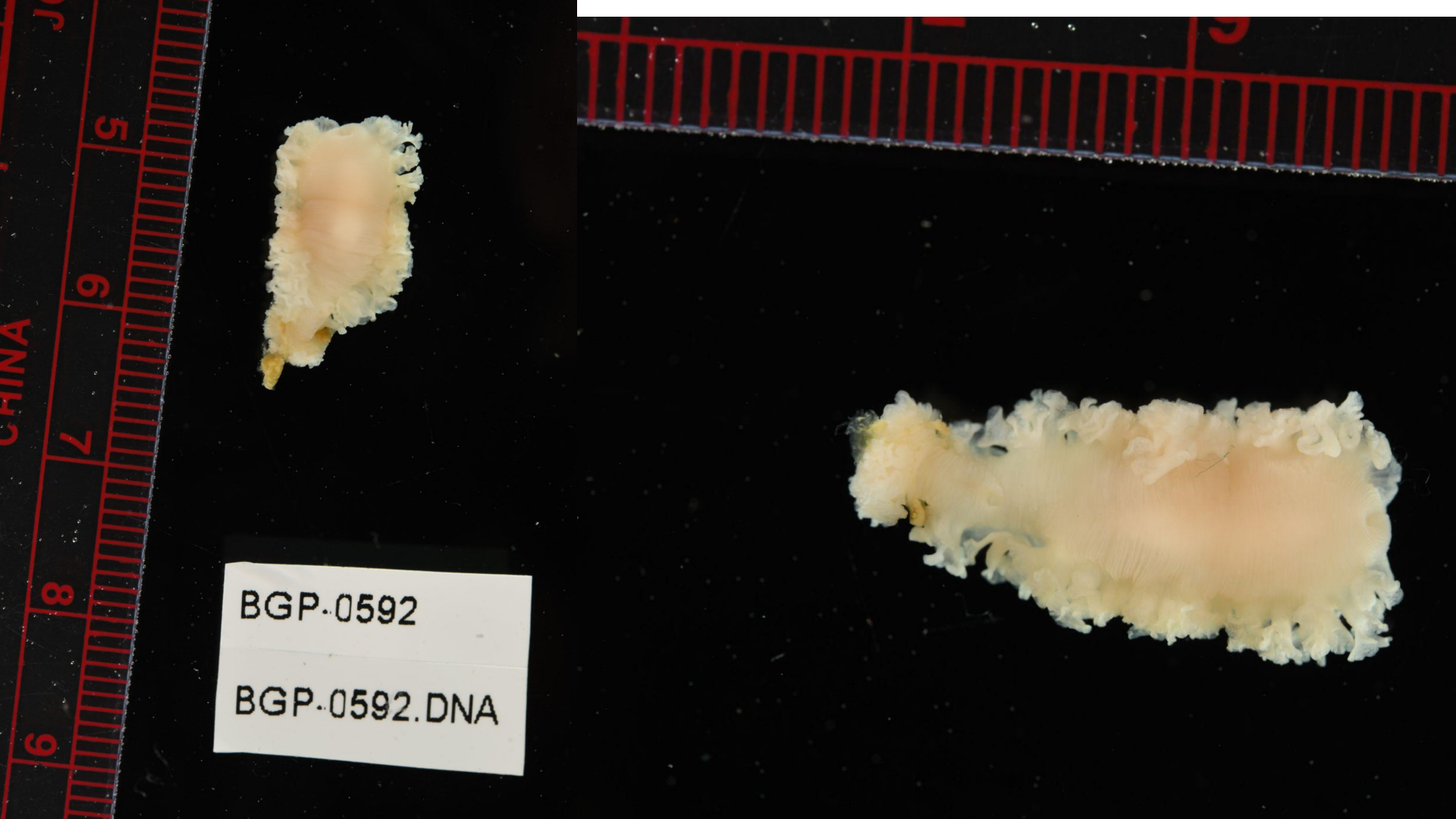
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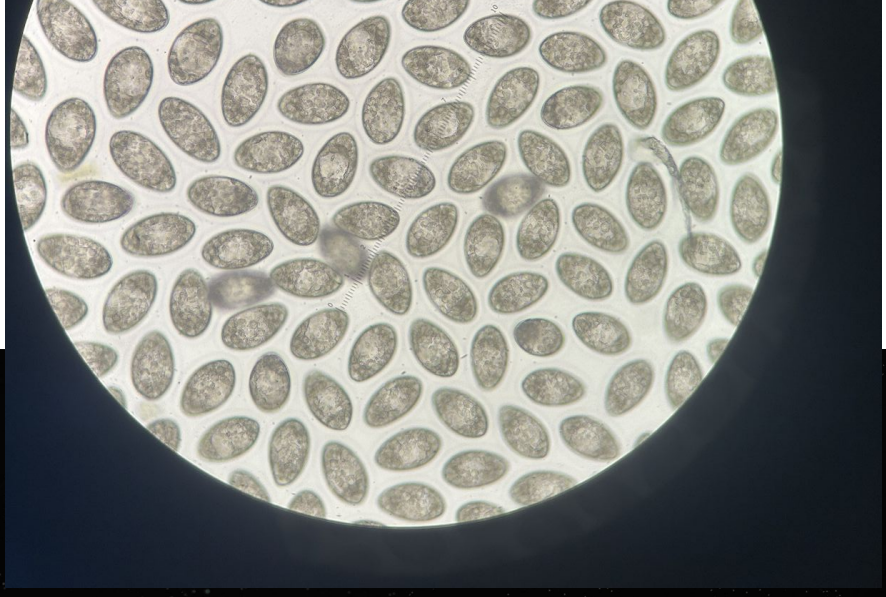

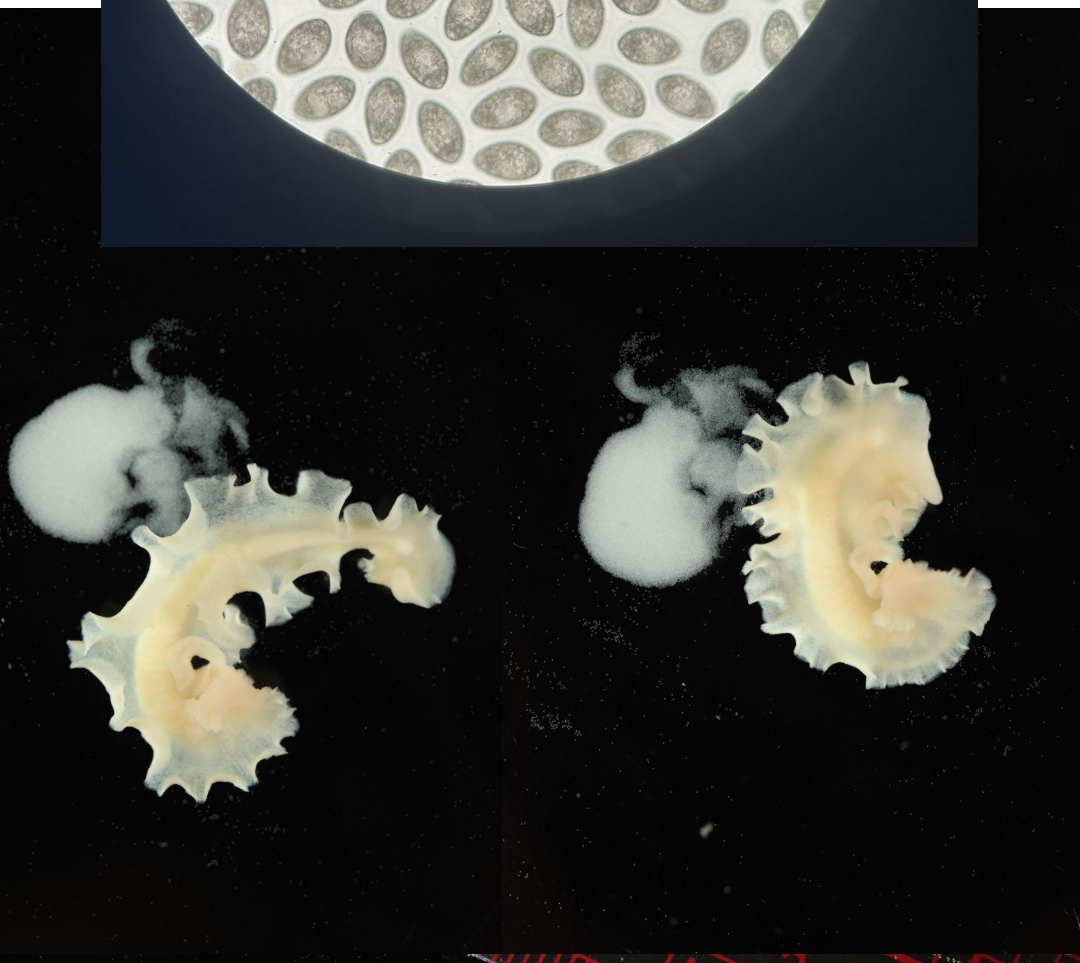

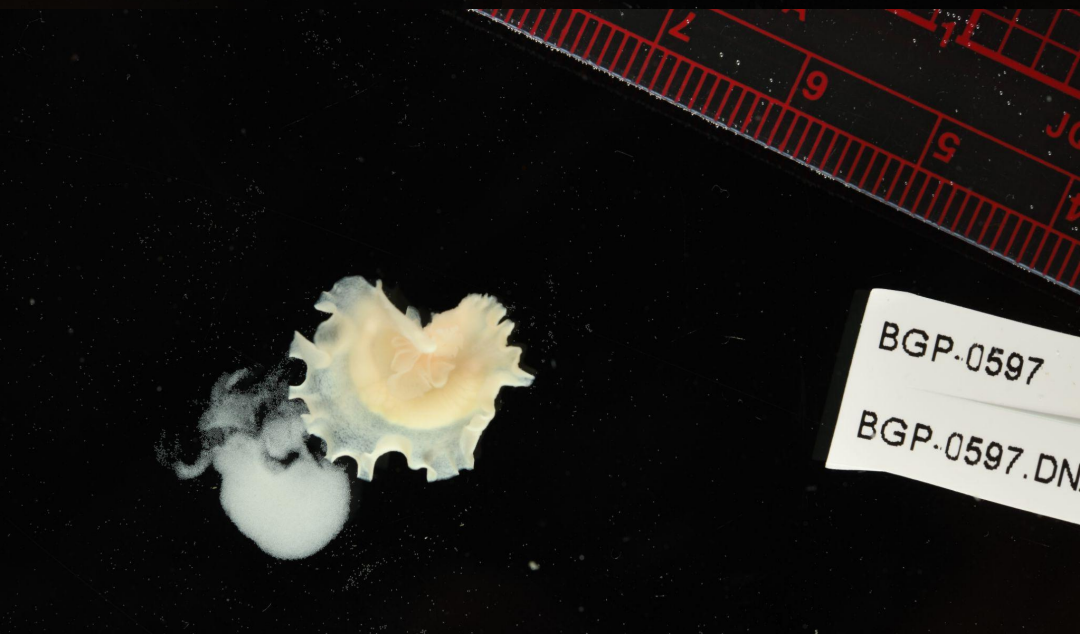
BGP-0597
BGP-0597.DN

Future work: Addressing knowledge gaps and constructing tangible data representations

- *O. robusta* parasite paper in the works
- Genotyping and sequencing of *Gyrocotyle* samples
- Barnacle and isopod specimens to potentially CT scan in the future
- “Mystery” specimens to be identified and genotyped
- Creating phylogenetic trees

Special Thanks to...!

- Dr. Rebecca Varney of the University of Nebraska
- Dr. Megan Schwartz of the University of Washington, Tacoma
- Dr. Gustav Paulay of the Florida Museum of Natural History
- Dr. Chelsea Wood of the University of Washington, Seattle

Thank you for watching!