IN SEARCH OF OCEANIC ANGLERFISH

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ABYSSAL AMBUSHERS

Field researcher and passionate conservationist Danté Fenolio reports on the DEEPEND project taking place in the waters of the Gulf of Mexico

This Bearded Seadevil *Linophryne* sp. has a relatively short *illicium*. On the opening spread, a profile of Murray's Black Seadevil *Melanocetus murrayi*, trawled from between 1,000 and 600 meters depth. This individual has a particularly steep forehead. All images courtesy of the DEEPEND project, by Danté Fenolio.

Top, author Dante Fenolio shows his excitement at finding a Bearded Seadevil, *Linophryne* sp., in a trawl.

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PHOTOS
BY DANTÉ FENOLIO

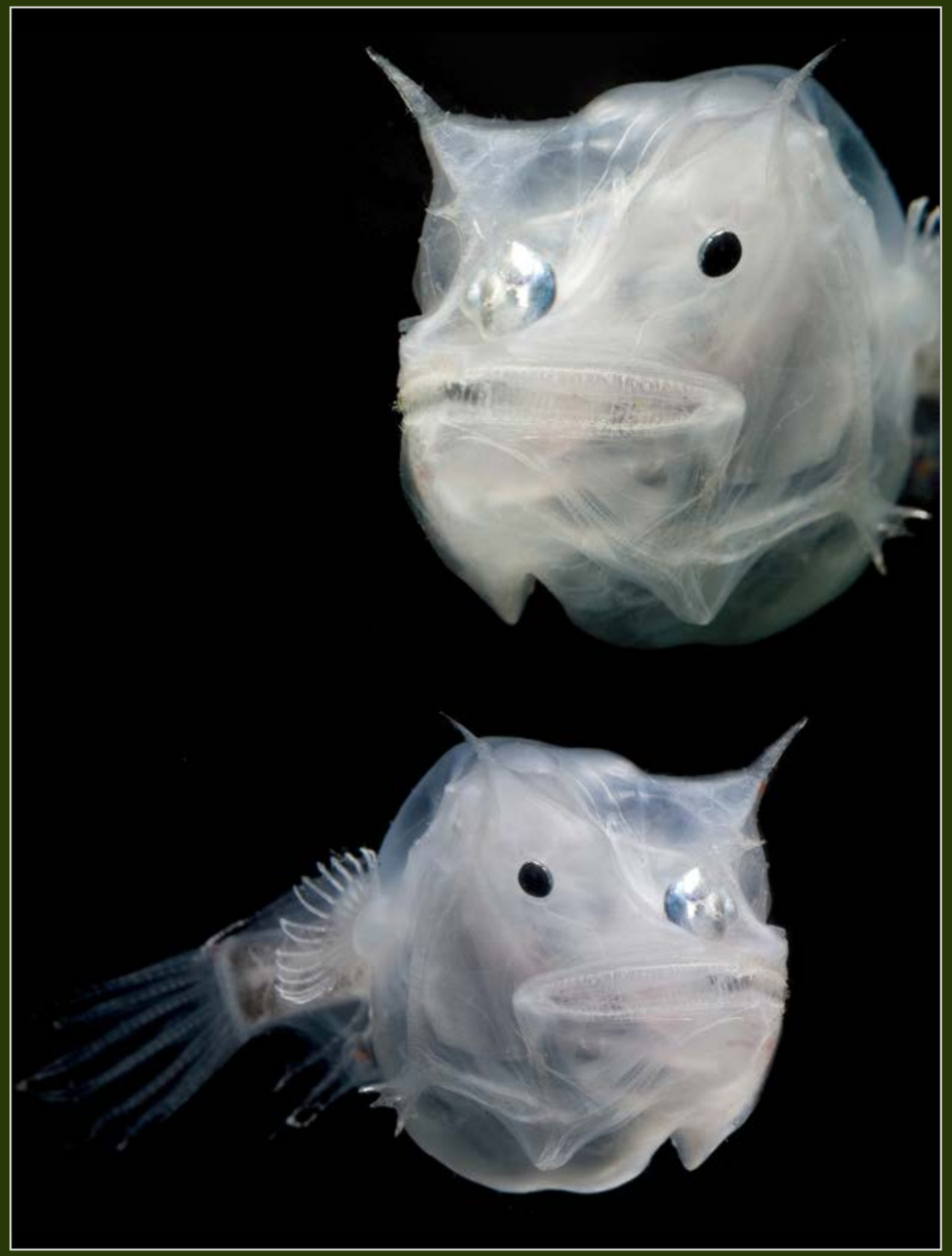
The evening was typically warm and humid. Thunderheads sat low on the horizon but as the moon began to rise, it made its way up through a break in the clouds. It was a blood red moon that evening – one of the few we have seen out on the Gulf of Mexico (GOM). The ship's diesel engines rumbled in the background. The sea was dead calm and we listened as the massive winch spooled the cable in and brought our net closer and closer to the ship. As the net neared the surface, it startled a small school of flying fish. They spooked and took to gliding. Several wound up on the sun weathered deck of the ship. We tossed them back into the water and waited for the giant winch to lift our net out of the sea.

Deep sea trawling is a game of chance and playing the numbers. Imagine yourself with a butterfly net in miles and miles of open field. In the entire field, there may be one or two specimens of a rare species. Even if you vigorously sweep the net through the field, the chances that you will capture the rare species is small. But the probability is proportional to the amount of the field that is swept. As sweeping continues, the probability of capturing a rare species slowly increases. The same applies to capturing an individual of any rarely encountered species in the ocean. While there may be more individuals of a rare species in the ocean, the "field" is many orders of magnitude larger than the field used in the example above. The take home message is that the more time you can trawl with your net open, the better you will do. In fact, trawling can and is demonstrated as a function of the amount of water that passed through the net during the trawl…an important metric when trying to calculate how frequently any given species is encountered while using this sampling method. For these reasons, a typical research cruise involving deep sea trawling lasts weeks, this one was no different. We had been hard at work, trawling virtually 24 hours a day, for well over a week before this tow had been made.

We began to pick through the net's haul - always hoping to see deep-sea anglerfishes. They aren't commonly encountered in any of the oceans around

continued on page 57 ❯

The Bulbous Dreamer *Oneirodes eschrichtii* has a complicated *esca* with multiple components. In addition, there are tube-like structures that protrude from the rear corners of the mouth and into the water column – these may glow in the dark as well. This specimen was collected from between 1,500 meters depth and the surface.



Left, Ghostly Seadevil *Haplophryne mollis* trawled from 1,200 meters depth, taken on research cruise organized by Dr. J. Torres; right, two adult female Doublewart Seadevils *Ceratias* sp. The top one was trawled from between 1,000 and 600 meters depth. The bottom one was trawled from between 600 and 200 meters depth.

Left, developmental sequence from related shallow water anglerfishes of the family *Antennariidae*, the "frogfishes." Similarly to their deep water cousins, frogfishes have an *esca* and an *illicium*; however, the *esca* does not glow in the dark. Right, a developmental series of anglerfishes in the family *Oneirodidae*.

Larval anglerfish typically are surrounded by a semi-transparent sac of tissue. This is a larval fish of the family *Oneirodidae* collected between 600 and 1000 meters depth.

Top, the net is hoisted onto the research ship. Bottom, Dr. Tracey Sutton working on the identification of an anglerfish based on the morphology of the fish's *esca*.

the world. But this night was going to reveal something really special. We poured the contents from one of the nets into a shallow tray and were amazed at what we saw. An adult Bearded Seadevil (*Linophryne* sp.) sat before us...and she had a male attached to her. There are a few cool things that you need to know about this fish in order to truly appreciate the event: (1) That we are aware, this is the only group of fishes that have evolved two entirely different bioluminescence systems. The "beard" that hangs off of the chin of the fish glows in the dark by way of "intrinsic bioluminescence," or light produced by the fish itself. The "lure" at the end of the "fishing rod" protruding from the forehead (a modified first dorsal ray) are known as an *esca* and *illicium* respectively. The *esca* glows in the dark through "symbiotic bioluminescence," or light produced by a bacterial symbiote. Again, it is exceptionally rare to have both bioluminescence systems evolve in the same organism. (2) Males of this family of anglerfishes are parasitic on the females. The male finds a female, bites her, and holds on. Ultimately, her skin grafts with his and her circulatory system connects with his. From that point on, she sustains him, even some of his organs degenerate. He becomes a built in sperm factory. (3) These fishes have expandable stomachs, allowing them to eat prey items that are nearly their own size. (4) Only the females grow into the monstrous fishes that we would recognize as an anglerfish (big teeth, glowing lure, and a larger size relative to the male). The male is smaller than the female. Surprising to some, not all species of anglerfishes have parasitic males, some species have free living males.

We have had an exceptional opportunity to examine a number of anglerfishes while working on the DEEPEND project in the GOM. The project is a three year effort that involves dozens of institutions and researchers. All are examining the impact of the Deepwater Horizon Oil Spill (DWHOS) on the mesopelagic fauna (animals living in the midwater) of the GOM. The group's mission statement is this, *"The DEEPEND consortium will characterize the oceanic ecosystem of the northern GOM to infer baseline conditions in the water column. This information will establish a time-series with which natural and anthropogenic changes can be detected."* The group also has a scope of work statement which reads, *"In response to the DWHOS and the highlighted absence of*

continued on page 62 ❯

A profile shot of Johnson's Black Seadevil *Melanocetus johnsoni*, trawled from between 1,500 meters depth and the surface.

Left, development of the Black Seadevils, *Melanocetus* sp., from the Gulf of Mexico. Early stages of the *illicium* and *esca* in the top three fishes and mature female fish at the bottom. Right, the Triplewart Seadevil, *Cryptopsaras couseii*, from 1,000 meters depth, has a blueberry shaped *esca* sitting stop a moderate length *illicium*.

The *illicium* is long and slender in the Black Seadevils. *Melanocetus johnsoni* has an *esca* shaped like a grape. Its most notable feature is the massive teeth. The one to the right was trawled from 1,200 meters depth on research cruise organized by Dr. J. Torres, by Danté Fenolio. The one to the left was collected from between 1,500 meters depth and the surface.

A profile shot of a Bearded Seadevil, *Linophryne* sp. B, trawled from between 1,500 meters depth and the surface, with a close-up of the *esca* in the upper right hand corner and a close-up of the "beard" in the lower right hand corner.

Left, Anglerfishes of the family *Gigantactinidae*. Top, *Rhynchactis leptonema* collected from between 1,500 meters depth and the surface. Middle, *Gigantactis gracilicauda* collected from between 1,500 meters depth and the surface. Bottom, *Gigantactis vanhoeffeni* collected at 900 meters depth on a research cruise organized by Dr. J. Torres, by Danté Fenolio. The top two images courtesy of the DEEPEND project, by Danté Fenolio.

baseline data for the deep GOM (200-1500 m) water column, the DEEPEND consortium will conduct a three year sampling, sensing, modeling, and laboratory analysis program to assess ecosystem dynamics, identify drivers of variability, and investigate possible consequences of the spill on ecosystem attributes. Data obtained during the 2010-2011 and 2015-2017 periods will establish a time-series with which ecosystem shifts or responses can be detected." Much more regarding the project and its research cruises can be found on the website – www.deependconsortium.org

Our intent is to share with the reader a variety of anglerfishes that have been encountered through deep water trawling in the GOM. Most of the images here come from DEEPEND work but a few are derived from independent research cruises with marine biologist Dr. Jose Torres. Those images are indicated as such in the captions. This group of deep water fishes are far more diverse than most people are aware. As a whole, the group is comprised of 11 families, 35 genera, and well over 150 species. An exact number of species is difficult to pin down as there are new anglerfishes being described right now, including a new species stemming from DEEPEND research. Anglerfishes are just one component of the deep water fauna of the world's oceans but it's a group we wanted to start sharing through public outreach. Our hope is that by delivering photo essays that depict slices of the ocean's biodiversity, we might inspire others to help conserve the biodiversity we currently enjoy.

An important side note – the animals depicted here were collected in the course of a scientific effort to discern the impact of the oil spill on the mesopelagic community of wildlife living in the GOM. The specimens hold incredible value for these studies as well as research involving taxonomy and ecology. But these images do not depict animals in the deep sea that were not touched in the course of photographing them. This is a full disclosure statement for the readers in acknowledgement of the fact that nearly all other articles in this magazine depict wildlife that has not been touched. Please do remember that the goals of our initiative are to conserve these amazing species and the GOM mesopelagic habitat - and we chose to take the time to try and share them with you, here.

Top left, a male anglerfish in the family *Linophrynidae* and the genus *Linophryne*. The male is attached to a female. Males with this type of ecology spend the early portions of their lives searching for a female. Clearly, chemoreception (chemical detection/reception) is involved owing to the well-developed nares and nasal rosette. These are structures used to detect chemicals in the water. Once the male locates a female, he bites her and holds on. Over some length of time, her tissue and his fuse. Her circulatory system begins to link with his system and she takes over providing the male with whatever his nutritional needs are and her blood and filtration systems take care of removing the cellular waste he produces. In some families, there is associated organ degeneration within the male. He is now reduced to a sperm factory and will provide sperm when the female is ready to produce eggs. This male and female were trawled from between 1,000 and 1,200 meters depth. Top right and bottom, the Spinyhead Seadevil, *Photocorynus spiniceps*, is another Linophrynid anglerfish with a relatively short *illicium*. This specimen was trawled from between 1,500 and 1,200 meters depth.