Alberto de Campo & Hannes Hoelzl and Students
Varia Zoosystematica Profundorum –
Experimental Studies in Deep Sea Communication

The installation *Varia Zoosystematica Profundorum* models a specific notion of how deep sea communication between specimens and across species might happen, inspired by the work of *zoosystematicien* Louis Bec and philosopher Vilem Flusser. The video of the installation featured here, is documentary of the version of the installation shown at the Singuhr Hörgalerie, Großer Wasserspeicher in Berlin, during the SuperCollider conference in Berlin in 2010.[1]

Developed over the course of the semester at the University of Arts (UdK) Berlin, the installation was based on the following premises: recent biological research shows that fish communicate much more by sounds than was previously assumed - for example, the catfish hunts by driving its prey into specific areas by making loud sounds. Marine mammals such as whales and probably dolphins are known to communicate acoustically over large distances; by comparison, very little is known about communication in the deep sea. From ca. 700m below the surface, the sea is completely dark, the only light sources are animals generating light by bioluminescence. As sound carries very well in water, it is plausible to assume that much deep sea communication is acoustic. Some species like the fawn cusk-eel (Lepophidium profundorum) are known to develop special muscles for making sounds during mating season, and some fish are known to make sounds by grinding their teeth; more unknown means of sound production are to be expected.

To address these open questions, the Generative Art/Computational Art class at UdK (Prof. Dr. Alberto de Campo), along with Hannes Hoelzl (*Institute For Music And Media, Music University Düsseldorf, Germany Institute for time-based media, Berlin University for the Arts, Berlin, Germany*) and Renate Wieser (*Graduate Program Automatisms, University of Paderborn, Germany)* developed models for Deep Sea communication, inspired by the work of Louis Bec and Vilem Flusser: A number of agents simulate aspects of the communicative behavior of different deep sea creatures. They transmit symbols ("letters") to each other which each individual assembles into longer chains

1 Singuhr Hörgalerie (Großer Wasserspeicher) is one of the most spectacular sites for presenting sound art works in Berlin. It is a former water reservoir for the city, built into an artificial hill, with a diameter of 40m, and five concentric rings of brick walls to hold the pressure from the water contained. The architecture is quite striking: it consists of 6m high circular corridors with vaulted ceilings, no daylight (except for an entrance cut into the hill later on), and it is highly reverberant (ca. 18 seconds reverb time overall, and more at lower frequencies).

("words"); when an agent / creature has collected a word it deems meaningful, it expresses that word by emitting sound, light, or motion patterns. Some creatures generate rhythmic pulse sequences, some almost melodic phrases. Others let hues of colors flash over their skins, while others again float up and down in space in response to the conversation between them.

The common model shared by all creatures emerging from all these threads, the creatures' brain design if you like, differs considerably from much evolutionary art; rather than following classical biologistical concepts (predator/prey, sexual reproduction, fight for resources), it focuses on the core of communicative behavior, the exchange of ideas. Very briefly, a number of actants ("creatures") transmit symbols ("letters") to each other, assemble incoming elements into longer chains ("words"), and sometimes express these "words" by emitting sound, light, or motion patterns. Obviously, the concept has been strongly influenced by its intended location (in the dark space of the *Singuhr Galerie*, Großer Wasserspeicher, Berlin), both in terms of the deep-sea habitat it refers to, as well as in focusing on acoustic communication in very reverberant settings, with light only playing a localised role.

How the creatures express their inner state, i.e. communicate their "words" to the others, is very open to the interpretation of the individual participants: various manifestations of a single evolutionary thread, with an astounding diversification of creatures. Some generate rhythmic pulse sequences, some create almost melodic phrases. Others have hues of colours that flash across their skins, while others again float up and down in space in response to the conversation between them. Simulating aspects of animal behavior allows studying phenomena that are difficult to observe in the wild; beyond that, given the freedom of such works in artistic contexts, one may also find that the strangeness of the unknown reflects the human world and its subjective experience in unexpected ways.

Artists:

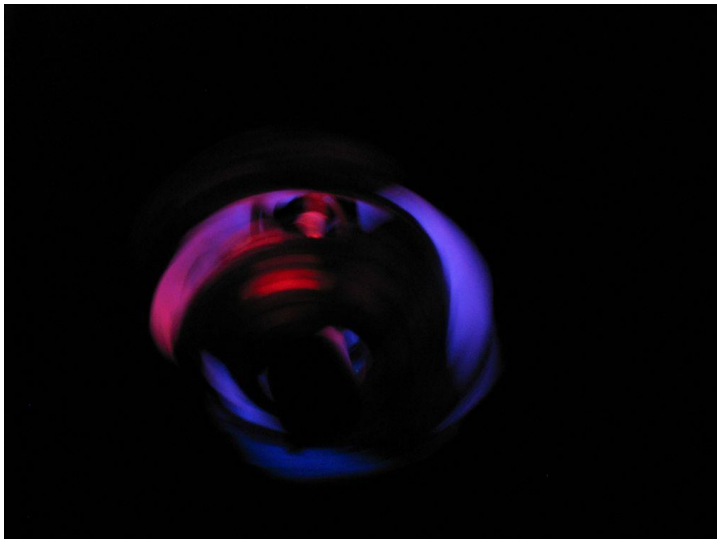
Alberto de Campo (AT), Hannes Hoelzl (I), Renate Wieser (DE), Bernhard Bauch (AT), Constantin Engelmann (DE), Dominik Hildebrand (DE), Akitoshi Honda (JP), Florian Kuehnle (DE), Ingrid Ladurner (I), Karin Lustenberger (CH), Rita Macedo (POR), Naomi Mulla (DE), Sarah Rechberger (AT), Johanna Tauber (DE), Andre Wakko (BRA), Christian Zollner (AT); Peter Bartz (DE), Tiago Cutileiro (POR), Annie Goh (UK), Tobias Purfuerst (DE).
Video: Ingrid Ladurner.

Description of creatures[2]

1. Paulantinautius divinatio

P. d. are deep sea octopuses belonging to the family of Bathypolypus arcticus. They normally live in depths from 1900m and below. Their most famous specimen was brought back to its original environment after playing the widely publicised role of Paul the" world championship oracle". After *Paul* [19] died on October, 26th, 2010, *Paulantinautius* is the only descendant beeing alive.

Model created by Bernhard Bauch.



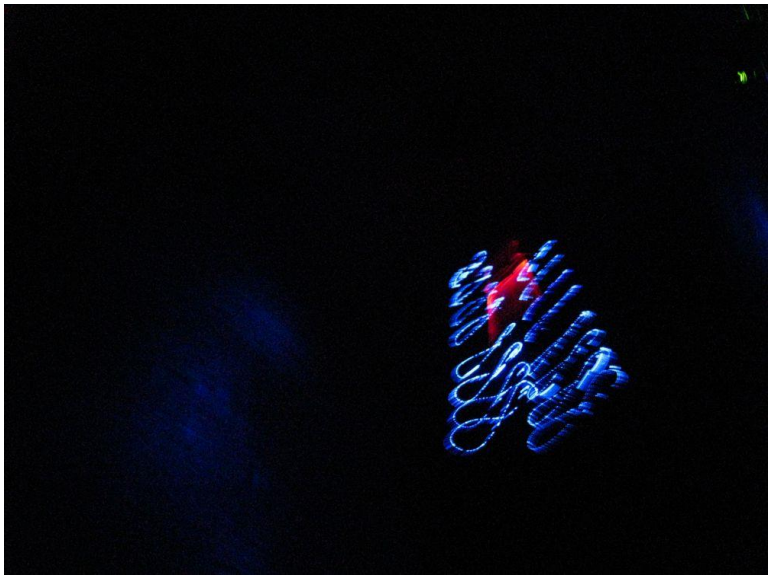
Paulantinautius divinatio

2. *Anarchiteuthis benjolinensis semiprofundus*

A. b.s. is a deep sea octopus belonging to the Subclass *Octopoda.* They are known to communicate by electromagnetic means. They produce moving bioluminscent hues on their skin, which are considered likely to be a form of communication; details on what they communicate are unclear. The model shown here focuses on its acoustic expression; its visual communication is only sketched here.

Model created by Alberto de Campo. Sound and light production use the Benjolin instrument designed by Rob Hoordijk.

[2] Photo Credits: Peter Bartz.



Flexotheuthis elongabilis

3. *Flexotheuthis elongabilis*

F. e. is an extremely rare species which lives exclusively in very deep marine crevices, below at least 2500 meters. They are extremely sensitive to changes in the electromagnetic field. Current research suggests that this sensitivity aids them in fleeing and seeking shelter when submarine earthquakes occur. F. possesses a bioluminiscent nervous system; interestingly, the nodes (two for each body segment) also create wide-spectrum sonic pulses, which can be heard over considerable distances. It is assumed that these sounds serve communication purposes with fellow specimens. Some researchers favor the interpretation that their "song" is a form of self-entertainment, and expresses their subjective well-being; their nervous system appears complex enough to justify the existence of such mental states. The model shown here is a baby *F.* of ca. 3m length when extended; until today only sub- adults have been found. Adult specimens are expected to continue growing as long as they live, and may easily reach lengths of 10-15 meters and more.

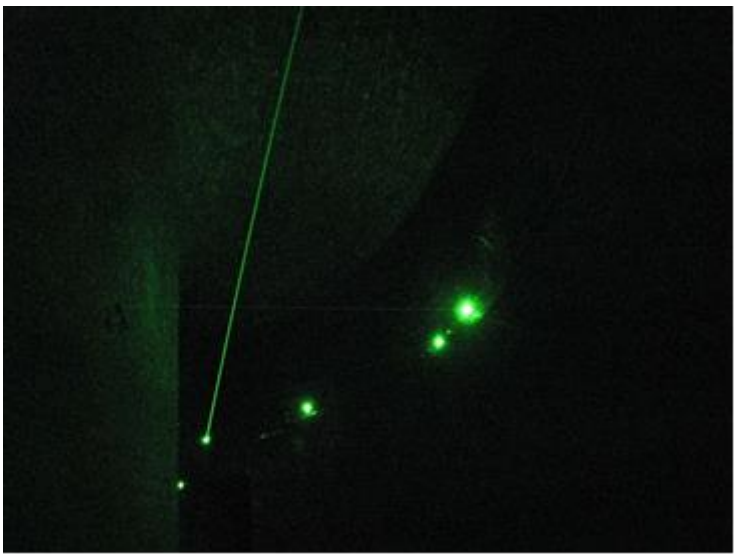
Model created by Dominik Hildebrand.

4. *Monatom* (also *Monon)*

M. is a very primitive unicellular organism probably belonging to the *Rhizaria* taxon. They are believed to be among the oldest life forms still in existence, and in very early phases of life on earth, it was the dominant life form across the globe. Today, *Monatoma* survive in the benthic zone. Strangely their life activity appears to be based on binary code: They exchange information

by means of bioluminiscent, directional light-beams in timed patterns, which bear some resemblance to Morse code. They have no fixed form or size, but are often observed to assemble in hexagonal forms; larger rhizomatic bodies composed of such hexagonal assemblies are observed up to very large sizes, going into hundreds of meters.

Model created by Akitoshi Honda.



Monatom

5. *Vuvuzeloida diaboli silvestris bandaniensis*

V.d.s.b. are deep sea worms belonging to the family of *Vuvuzeloida infernalis*. The cone-shaped worm has first been observed in deep crevices in the Banda Sea (South Moluccas in Indonesia). As the genus is phylogenetically very old, it is expected that isolated populations of *V.* will be found in far apart submarine environments. *V.ae* are known to communicate by producing crackling sounds, which are somewhat similar to the Indonesian traditional instrument called "Forest Devil". When *Vuvuzeloidae* appear in larger flocks (also called schools), they tend to produce a pandemonium of loud monotonous sounds.

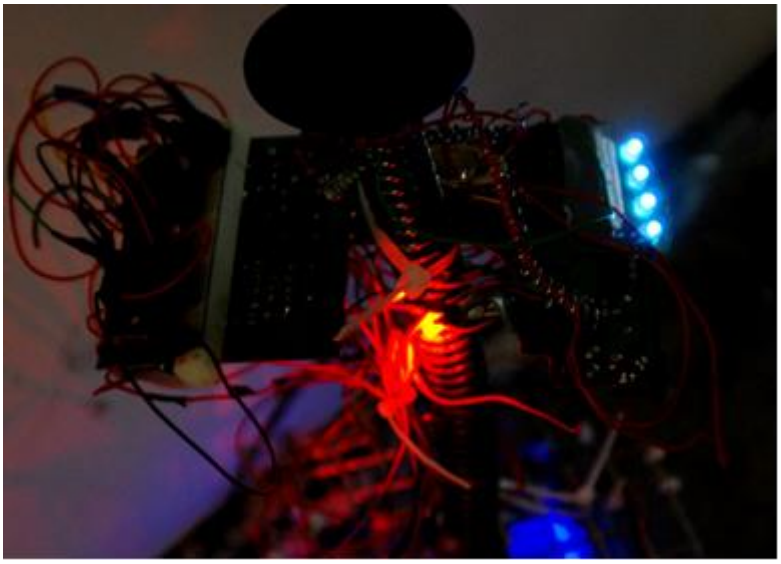
Model created by Ingrid Ladurner.

6. *Suithisaurus turbulens spasmodicus*

"Sweetysourus" (Suithisaurus turbulens spasmodicus) has first been found in the Indian Ocean, off the Island of Sri Lanka. Initially it was believed that the found object was only the skeleton of a previously unknown tropical *saurian* that has sunken into the deep sea after being dislocated

by a monsoon storm. Later sightings have revealed that it is in fact a living being, which has quite complex behavior patterns; e.g., it has what looks like shiver spasms about 30-40 times per hour. It was named by an Irish marine biologist after the Gaelic word for skill (with the vernacular name being an unfortunate example of scientist humor).

Model created by Karin Lustenberger.



Suithisaurus turbulens spasmodicus

7. *Laufwerk (Testudo marino-digitalis monopedes)*

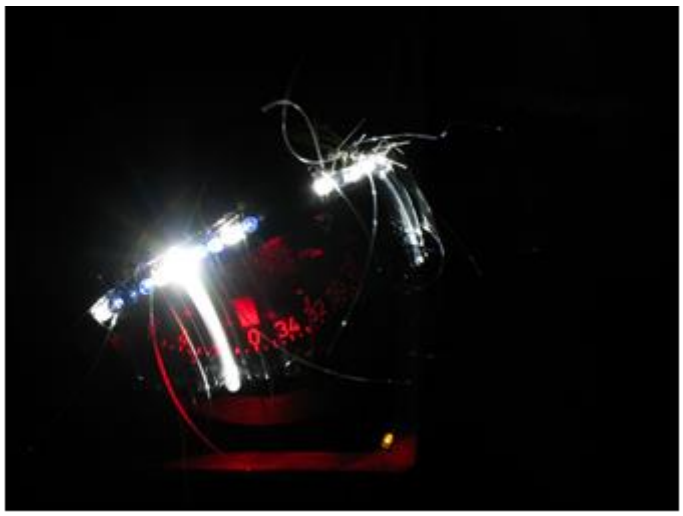
Laufwerke are marine testudides, and as such, members of the order stomatopoda. They live in the benthic zone of the deep sea and reach a typical length of 19 cm, and 31cm with their mouth open. Due to their extravagant mouth-apparatus, Laufwerke are the only species known that appear to grow by half of their normal body-length during ingestion. Lacking a stomach, brain and almost everything except for the mouth, the predominant task in life of a laufwerk is eating. Due to the absent stomach, and the resulting inability to store food, Laufwerk requires a constant supply of nutrition.

Model created by Naomi Mulla.

8. *Cyclops Significans*

S. is an as yet unclassified inhabitant of the deep sea, arguably belonging to the Oculopodae. With its elaborate eyelashes, C. S. produces an rather spectacular gaze based on bioluminescence

and sonic endo-resonance. *Model created by Christian Zollner.*



Cyclops Significans

9. *Humilis coconis*

First traces of *H. c.* were found in the deep waters of the Lapulapu Ridge in the northern Pacific Ocean during underwater audio recordings. Instead of the expected whale song that was the intended object to be studied, interference signals were picked up; since then researchers have tried to locate the origin of the sounds. Months later, a first picture of the humilis coconis could be taken (shown above) about 4200 meters below sea level almost at the same place. Since then speculations abound about their taxonomical classification, their way of reproduction and their communication behavior. Researchers assume that the humilis coconis uses its inner organs to create some kind of feedback frequencies and is able to amplify them through the resonating shape of its body. Nuclear radiation seems to have caused mutations in *H.C.* which enables them to reuse industrial waste in multiple ways, e.g. for their sound-producing body shells.

Model created by Tobias Purfürst.

10. *Variotuethis*

Variotuethis was first sighted very shortly before the V. Z. P. installation. It appears that Variotuethis can split into multiple segments, which can survive as independent organisms after this giant version of cell proliferation. Variothuetis were found in association with hydrothermal vents. It is very likely that Variothuetis evolved out of the Siboglinidae (worms that grow in tubes), which overgrow the steep gradients of the black smokers. The mystery about Variothuetis is the enormous size it developed in an obviously very short period of time. First speculations

call hydrogen sulfide to account for the rapid growth. Hydrogen sulfid is produced during the hydrothermal activity of the black smokers. Tube worms depend on this chemical, which is highly toxic to most known organisms. Variothuetis seems unable to produce organic material through the process of chemosynthesis out of hydrogen sulfide. Instead the gas appears to accumulate within Variothuetis, which results in an inflation of the whole organism.

Model created by J. Tauber and N. Mulla.

11. *Meteor Deep*

The exact origin of this periodic submarine noise is unknown. Its sounds can reach over several hundred kilometres. It is believed to come fro volcanic eruptions or seismic oscillations, as high amounts of energy are needed to send these signals over such distances.

The crackling sound, shifting rhythmically from high to low frequencies is also modulated from time to time showing resonances of specific frequencies. The peaks in the frequency spectrum seem to show morse code like messages in some of the signals.

By sonic triangulation, the source was located in the South Sandwich Trench, the so called Meteor Deep (55°40'S, 025°55'W) in the South Atlantic, at 8428m depth.

Model created by Constantin Engelmann.

Glomus Raucus Pellucensis

12. Glomus Raucus Pellucensis

G, R. P. is a small multicellular organism that lives in the very deep areas of the sea (8000 - 9000

m). His overall corpus consists of several discs that resemble each other in shape and function. By repeatedly shifting the single discs in relation to each other, the Glomus R. P. is able to advance through the water. The sounds resulting from those movements are of a scratchy and coarse kind, which explains the origin of the Glomus' name. To Face the tremendous water pressure that exists in his habitat, the fragile- looking Glomus R. P. makes use of a semi-open cell design; thereby annulling the human-made dichotomy of "inside/outside".

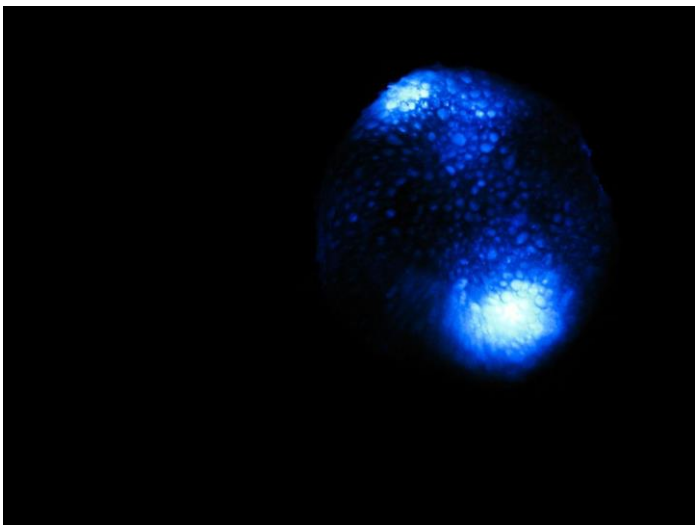
Model created by Florian Kühnle.

13. *Spongia naturalis misericordiae commota* and *Spongia domestica neurotica*

In the family of sponge organisms, the Porifera, this recent discovery has been nicknamed "Gary". Gary consists of many sponges of *Spongia naturalis misericordiae commota (S.N.M.C.)* living in a symbiotic network structure with *Spongia domestica neurotica (S.D.N.).* The image shows what is called Gary's heart. This sponge is moving consistently and rhythmically like a mammalian heart muscle and this movement produces a sound similar to human breathing.

Furthermore, clear blue light is emitted by this heart muscle. Two rays appearing irregularly suggest that this structure is also Gary's eyes. Some researchers hypothesize deep philosophical (bordering on spiritual) implications here.

Models created by Petja Ivanova.



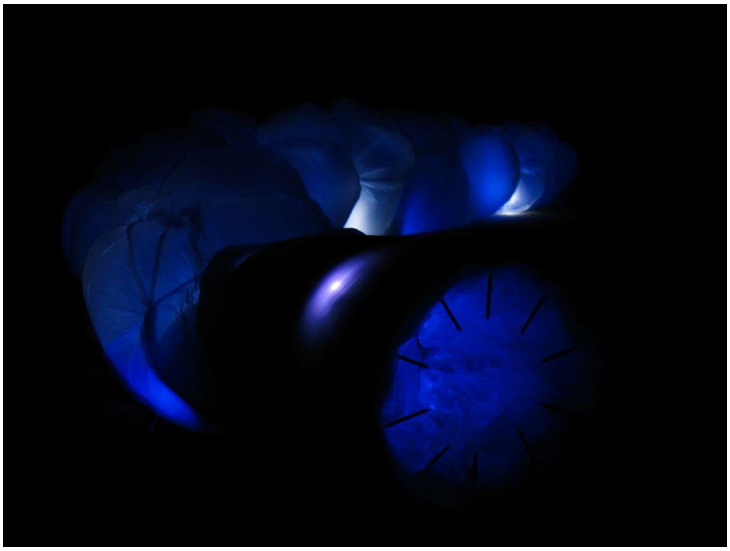
Spongia naturalis misericordiae commota

Spongia domestica neurotica

14. *Hydrophis Profundorum Illuminatus*

H. P. I. belongs to the omnivorous sea snakes. Besides chasing prey actively, it also maintains a permanent stream of water through its body, which is filtered for nutrition. It is the object of speculations whether H. communicates mainly by hydroacoustic means or also electromagnetically.

Model created by Peter Bartz.

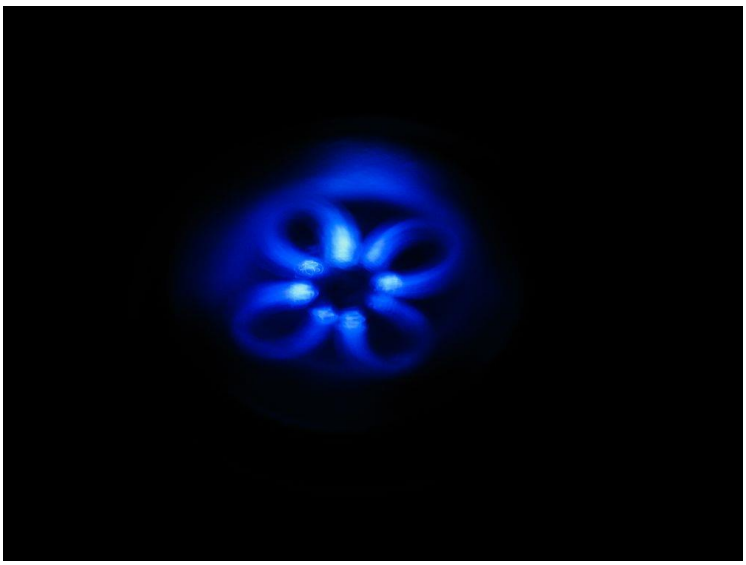


Hydrophis Profundorum Illuminatus

15. *Auralia Oscillia*

The Wobbling Moon Jellyfish, commonly known as the 'Wobble Squid' is a sea jelly that resembles a floating mushroom, closely related to the Aurelia Aurita or common Moon Jellyfish (dt. Ohrenqualle). Four horseshoe shaped gonads situated at the bottom of the stomach are a distinctive feature of the Moon Jellyfish. In Eastern mythology, the jellyfish tried to deceive the dragon king Rinjin, who then beat him and pulled out all the bones of his body. Indeed, Moon Jellyfish possess neither bones nor brain, heart, blood, head, eyes or ears and consist basically of a floating mouth/anus and digestive system. Thus, the Moon Jellyfish can be appreciated for its simplistic anatomy and vengeful and poisonous nature. In contrast to the common Moon Jellyfish, the Auralia Oscillia emits a low frequency oscillation perceived as a low wobbling sound as their sting cells (nematocysts) prepare to emit poison in order to capture prey. This mutation is currently understood to function by stunning prey before stinging as an additional mode of attack.

Model created by Annie Goh.



Auralia Oscillia

16. *Pringuzela Sospirosa Succubita*

Pringuzela S.S.'s long-stretched body is surprisingly angular for a marine animal, with the cylindrical gastro-oral apparatus most prominently developed around a tendinous structure with what seem to be two solar plexi, each attributed to a strong muscular texture, while the brain is only about 9% the weight of comparable Pringuzelae. Its digestive cavity seems to have co-evolved into a resonant tube for deep sea acoustic communication. Projection of the sound is highly directional and it is vaguely resembling humanoid phonemes at varying pitches, with sentimental glissando motives being as common as short disrupted utterings. *P.ae* seem to appear in great masses at periodic intervals of 2 or 4 years in the warm season, coincident, for no apparent reason, with global events of sporty nature. Yet, this is the first specimen ever brought to surface and kept alive. *P.ae* feed on anything salty from the oceans, but seemingly also a root of hitherto unknown origin, rich in carbohydrates. A better known fact is, that it serves as a main source of nutrition for a great number of bipedal animals, especially when in a state of relaxation. *Model created by Hannes Hoelzl, inspired by Ralf Schreiber.*

see also: Acta infernalia 2010/7, pp 42-66.

De Campo, A., Hölzl, H., Wieser, R., Varia Zoosystematica Profundorum

Modelling deep sea communication collectively. *13th Generative Art Conference GA2010.* http://www.generativeart.com/on/cic/GA2010/b3.pdf.

Fine, M.L., Lin, H., Nguyen, B.B., Rountree, R.A., Cameron, T.M., and Parmentier, E. 2007. Functional morphology of the sonic apparatus of the fawn cusk-eel Lepophidium profundorum. Journal of Morphology. 268:953-966.

Flusser, V., and Bec, L. Vampyroteuthis infernalis. 1993, Göttingen.

Varia zoosystematica profundorum, vol XVII nr 3, pp 21-45.