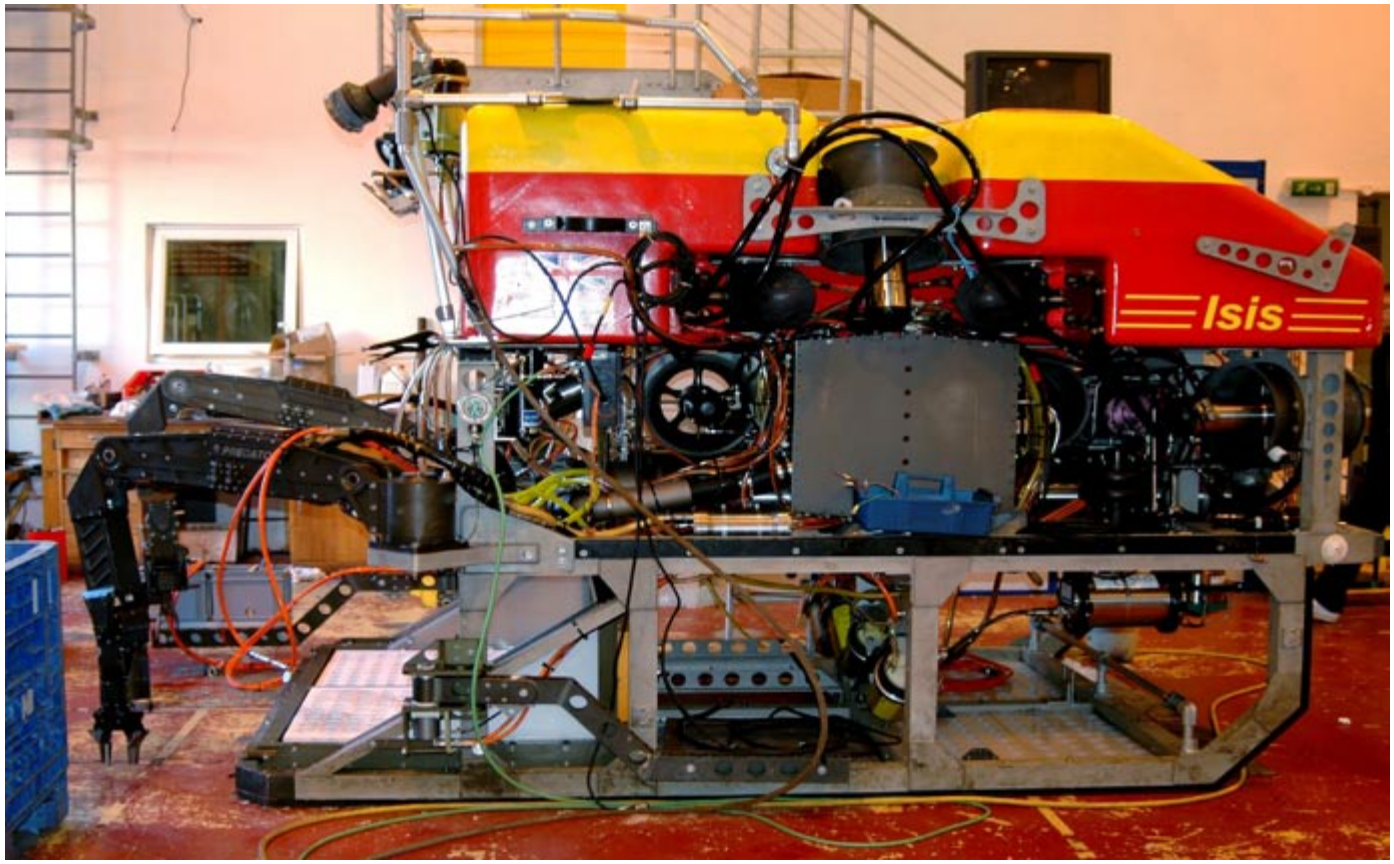
"Gelatinous bonanza" for the deep ocean beasts by Mario Lebrato

When we "human animals" feel hungry, a shop next to our home may fulfill our necessities, while the creatures that live thousands of meters deep in the oceans need to patiently wait for their "meal" to just arrive to them. Life forms in the surface waters of the ocean slowly sink once dead, disappearing and becoming part of the mysterious and unexplored abyssal depths below where no light from the sun can reach. Thanks to the advances in technology, scientists can now observe the mighstiest corners of the ocean with the aid of ROVs (submarines), or Remote Operated Vehicles, in real time, thus challenging and describing the fait of animals that where once in the surface, but are now deep into an "ocean of mystery". These incredible pieces of gear allow a wide range of functions and sampling possibilities, with several cameras and controlled arms that can grab, twist, or suck almost any type of sample.

At present several research lines are delving into the knowledge of what happens to jellyfish-like

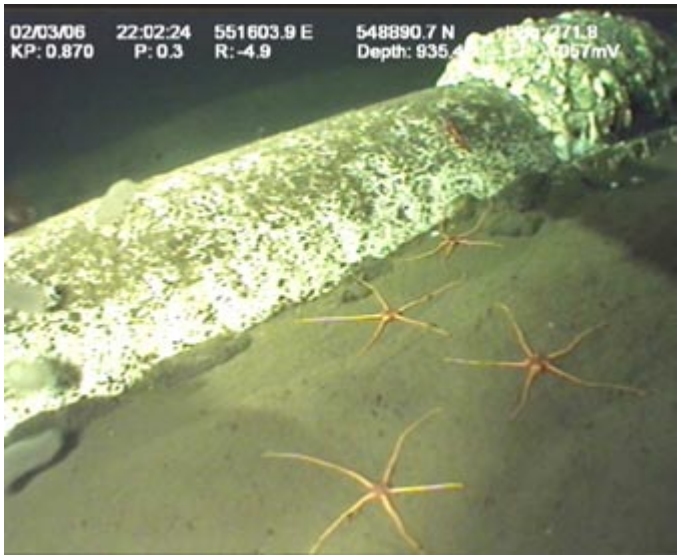


(Top) ROV Isis in the National Oceanography Centre. A similar one was used in the Ivory Coast study.

(Left) Pyrosoma moribund corpses at 1251 meters, with a sea star Solaster sp. feeding.

(Right) Angular Roughshark Oxynotus centrina near the pipelines. Probably they will scavenge or predate on other animals and not directly on Pyrosoma corpses.

Anemone, probably Actinostola sp. feeding in the middle of a patch of Pyrosoma accumulated in the continental slope channel.



Ophiuroids feeding on the sandy bottom.

creatures once they die and sink to the bottom of the ocean. A creature scientifically named as Pyrosoma sp., which forms part of the floating life in the surface waters (or plankton) is a close "relative" to jellyfish, gelatinous creatures by nature that form massive swarms at the very ocean surface. Once Pyrosoma die, their moribund bodies sink down to deep waters in mass as it can be seen in the image, where an incredible number of creatures feast on this "bonanza" indirectly "manufactured" by the action of the sun. This is so because Pyrosoma feeds on floating algae commonly known as phytoplankton, which carry out photosynthesis, taking advantage of the well-lit surface waters of the ocean.

The study was carried out in 2006 off West Africa in Ivory Coast, as part of the SERPENT Project in collaboration with the oil industry. ROV videos were retrieved from surface waters down to more than 1000 meters along oil pipelines, and this enabled the possibility of studying the fate of Pyrosoma once they die and became available for the creatures down to 1000 meters. These findings add new and intriguing data into the food resources available for deep ocean animals that were once believed to be only derived from phytoplanktonic production. A recent study in 2006 by David Billett and colleagues in the Arabian Sea described for the first time the fate of jellyfish creature's mass deposition in the deep ocean, but direct feeding observations such as the ones provided in our recent study are extremely rare. This study shows how important episodic food events may be in maintaining ecosystem functionality and ecological diversity. This work is not only attractive from a scientific point of view, but also from a photographic perspective, since new behaviors and curious "animals" can be framed. Bringing images to the surface from more than 1000 meters is a challenging business and the quality is not as good as conventional underwater photography. The images are rather quantitative than qualitative, and they rely on their uniqueness even if they are poor in terms of artistic composition. ROV imagery is proving as a powerful tool in science, and I think it not only needs to be used to drive scientific initiatives, but also the public needs to get some kind of visual access to experience what is going on in the abyss.

The science behind the images

Population explosions of jellyfish and other zooplanktonic gelatinous organisms are common in the oceans, affecting shallow ecosystems processes and dynamics. Their production in mass has been known to potentially affect the transfer of organic matter (carbon) to the deep sea benthos, thus providing additional resources to an already "low food" environment (as the deep sea is sometimes described). Organic carbon can enter the deep sea ecosystem as small detrital particles, episodic deliveries of large organic parcels such as large animal carcasses, actively swimming/dead zooplankton, turbidity currents, and macrophyte detritus (as described by Rowe, 1981). The relative importance of these organic carbon pathways is widely recognized to vary between habitat and distance from the neritic waters, although practical quantification remains still in its infancy (after Gage and Tyler, 1991). The present use of ROVs

Inside Isis ROV control box.

will certainly facilitate the quantification of these episodic events, which are know to act as "historical vectors" of food down to the deep ocean.

Populations of Pyrosoma, which are known as salps, feed on phytoplankton at the surface waters, and collapse once particle concentrations exceed an approximate threshold of 1 mg Chl. a m-3 (as defined by Perissinotto and Pakhomov, 1998). This is related to the inability of salps to regulate their filtration rate, and avoid clogging of the feeding apparatus. The use of Chl. a maps in this study enabled to monitor at a local and regional scale the phytoplankton concentrations in the months prior to the observation of Pyrosoma at the bottom, thus relating their benthic availability with the production in the surface. Passive sinking of the bodies coupled with deposition at the seabed and subsequent transfer by turbidity currents, canyons and channels may explain their appearance in the deep sea benthic environment. The "patchy" nature of the deposition along with its spatiotemporal heterogeneity may create hotspots of organic material from the continental shelf of Ivory Coast down to the abyssal depths. This certainly influences the community distribution and diversity adding new insights and controversy into the changes in diversity with depth, which is not only a function of the "pressure" but may also covariate with organic matter availability and other environmental factors.

Implications for the future

Going beyond pure observational and rationale interpretations, it is known that climate change will affect the distribution and abundance of jellyfish-like creatures with a tendency to overpopulation. This certainly will lead to changes in the flow of food they provide that sinks directly to the benthic inhabitants. It is known that large patches of organic material can cause anoxia due to oxygen consumption/exhaustion, and that excesses in food inputs lead to a reduction in diversity and a tendency towards opportunistic behaviour. In this subtle way, ecosystem dynamics are believed to be altered as a consequence of global changes, with major implications in the relationships between trophic levels. We are still discovering how deep sea animals get their food supplies, and we are still keen on finding out what global changes may bring to their life-styles and ecology. Some people think everything would change, others believe in genetic adaptations and fast evolution at the genetic level towards adaptive strategies. Personally, I believe that species-specific and ecosystem-specific effects will be the reality in the future, since different life strategies and histories may lead to different ways of coping with the same pressures. We as individuals may be able to do something from our sides, our "little bit" in all of those daily activities that added globally make up the big one. Even if we know that our primary actions will not be manifested in real time in something that is tangible for us, our "materialistic nature" may at least feel a bit of relief in knowing that "it was our intention" to do something.

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