BIODIVERSITY AND CONNECTIVITY OF BENTHIC COMMUNITIES IN ORGANIC-RICH HABITATS IN THE DEEP SW ATLANTIC – BIOSUOR

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Figure 1. The bone specialist Osedax *sp. nov. (green) infesting a minke whale intervertebral disk. This is the deepest living species of* Osedax *found to date (ca. 4204 m) and the first to be found in the deep Atlantic Ocean.* Osedax *produces acid to dissolve the bone matrix in order to absorb collagen and lipids. Photo: Yoshihiro Fujiwara (JAMSTEC).*

The BIOTA/FAPESP program is an effort that has been mapping the biological diversity of terrestrial and aquatic ecosystems in the State of Sao Paulo with extreme success. In marine areas, this effort has historically been concentrated in coastal ecosystems, leaving the deep ocean biota habitat - one of the largest global repositories of species - largely unknown. Evidence shows that organic islands contribute significantly to deep benthic biodiversity, with highly specialized life histories. However, there is a large gap on the large-scale patterns of biodiversity, biogeography and connectivity of the populations that exploit these islands, as well as on the relationships between diversity and ecosystem function. The present proposal aims to study the biota associated with organic-rich islands in the deep-sea (whale bones and wood parcels) in the SE Brazilian margin, in areas under whale migratory routes and historical proximity to large continental forests. In order to address these questions, we will use an advanced experimental design through the implantation of whale bones and wood parcels using low-cost autonomous vehicles (landers) at depths of 1500 and 3000 m along the Brazilian continental margin for 15 months, allowing the colonization of substrates by specialized micro- and macroorganisms. Ecological, molecular and genetic analyses of whale bone and wood associated macro- and microfauna will be used to address regional and bathymetric patterns of benthic biota, the connectivity between populations of specialists in the Southwest Atlantic and also their trophic and ecosystem function in the degradation of organic substrates in the deep SW Atlantic. Interbasin comparison of biodiversity and functioning of these islands (SW Atlantic vs. NE Pacific) will be achieved through an international collaboration project, which will be jointly submitted to the National Science Foundation by Dr. Craig R. Smith of the University of Hawaii. This is a highly innovative scientific proposal in Brazil, with national and international partners of high scientific level, and will use a pioneer low-cost methodology in deep sea ecosystems, which are areas of difficult access with the resources previously available for institutions in São Paulo and Brazil, but that should be facilitated by investments made by FAPESP and IOUSP, with the recent purchase of a new oceanographic vessel and a research boat.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

The deep-sea is a highly oligotrophic environment which, over the evolutionary time, has selected organisms that take advantage of any organic material they might find. This is seen in the extremely toxic hydrothermal vents, where organisms live symbiotically with chemoautotrophic bacteria in nasty, sulfide rich environments. Large food falls may also produce such reduced habitats and attract a suite of opportunistic organisms. Even more, they have also produced evolutionary novelties that specialize in taking advantage of such large food feast. However, food falls like large whale carcasses and wood parcels are very localized islands in the huge deep-ocean. How do organisms find such islands and how are the populations connected? We proposed that connections would be higher along places with similar depths but not across isobaths, regardless the distance (i.e., hundreds of kilometers) (Figure 1). Our data, still under analysis, show surprisingly these islands may be highly connected even across depths. While some species may be isolated by depth, many others occur in very different conditions (1500 and 3300 m depth). What is more astonishing is that many of our species are shared with those from the NE Pacific Basin. These data are supported by morphological and molecular analyses.

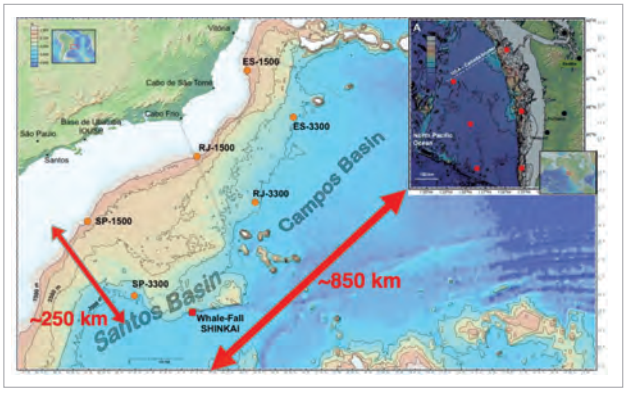

Figure 1. The large map shows the stations where the organic parcels were implanted along the SE Brazilian continental margin. The inset shows the same experiment carried out by our collaborators of the University of Hawaii and Auburn University on the continental margin off the coast of Oregon and Washington States, NE Pacific, USA.

Therefore, our data suggest that populations are highly connected by the probably common food falls. In addition, results found for the vent/seep endemic shrimp Alvinocaris muricola indicate that whale falls may serve as ecological stepping stones for the dispersal in reducing environments. A. muricola was found for the first time in whale bones in the present study, supporting the hypothesis that organic falls may have had an important role in the colonization and maintenance of hydrothermal vent and cold seep faunas.

Figure 2. The deep diving research submersible Shinkai 6500 (JAMSTEC) prepares to dive in the deep SW Atlantic Ocean off the coast of Brazil. During one of the dives, a natural whale carcass was found lying at the bottom of the ocean and it has been used for comparison with the bone fauna implanted during the BioSuOr Project. (Photo: Paulo Sumida).

MAIN PUBLICATIONS

Sumida PYG, Alfaro-Lucas JM, Shimabukuro M, Kitazato H, Perez JAA, Soares-Gomes A, Toyofuku T, Lima AOS, Ara K, Fujiwara Y. 2016. Deep-sea whale fall fauna from the Atlantic resembles that of the Pacific Ocean. *Scientific Reports*. **6**: 22139.

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Alfaro-Lucas JM, Shimabukuro M, Ferreira GD, Kitazato H, Fujiwara Y, Sumida PYG (no prelo). The dark side of deep-sea whale-fall communities: rich bone-hidden assemblages and the ecological role of Osedax. *Deep-Sea Research II*.

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