

Supplementary Materials: Toward a reliable analogous model

The final setting of the experiments has been achieved after a long period of attempts (eight months) to improve the model representativeness. Intermediate experiments were used to set final procedures of the analogue experiments. An exhaustive discussion of the attempts made before arriving at the final analogous model can be useful to highlight the experimental limitations of the previous studies, and to understand how we arrived at the final realistic analogue model.

Table S1. Different experiments carried out for this work.

Experiment	Description
1 st experiment	Some isolated tubes put into the Petri capsule
2 nd experiment	Fragments of bioconstruction in a test tank increasing the range of velocities reached in previous works [21].
3 rd experiment (Final configuration of tests)	Three fragments have been inserted in each sector. Using a special device system, sands of a different nature were suspended in tanks. Finally, the tube growths were measured. <ul style="list-style-type: none">• First phase: the selected particle size is between 125 μm and 350 μm• Second phase: the selected grain size is slightly larger and between 350 μm and 500 μm.

An interesting experiment on the vitality of polychaetes outside their environment was carried out by [43], nevertheless with different species from the object of this study, such as *Sabella spallanzanii* (Gmelin, 1791) and *Sabella pavonina* Savigny 1822. Fox analyzed in oxygen-poor waters and described the good persistence of these polychaetes to severe external conditions, but only if individuals were provided with their primary sand tubes. In a test tank, three submerged Petri dishes containing 10 *S. spinulosa* individuals deprived of their sandy tubes have been placed. In each Petri dish was introduced a different selected sand. In another test tank, the same configuration was prepared for worm individuals with their primary tubes. In both cases, the worms survived five to six days: they partially interacted with sands without building tubes, while in the case of individuals with tubes, they abandoned them after a few hours. Better results have been achieved using reef fragments and the same general settings in the aquaria. Worms were vital for a very long time (more than 6 months), but without interaction with sand particles placed around reef fragments.

The second set of experiments was realized to reach values of water flow velocity in agreement with actual storm wave-dominated environments and increase the range of velocities reached in previous works (see Vortex Resuspension Tank experiments [21]). A powerful aquarium wave-maker was introduced in the 60 cm x 40 cm x 40 cm tank (Fig. 1) and the water flow occurred with velocities between 1 and 2 m/s. In different tests, three types of sand were placed at the tank base, while a reef fragment of approximately 10 cm x 10 cm x 5 cm was put

on a small platform (with 3 cm of elevation above the sandy substrate). In this configuration, sands moved toward the wall and, after a bouncing trajectory, deposited in the reef fragment area. Every day (for 20 test days), storm-waves events (6 hours in duration) were alternated with calm periods (18 hours). Carefully setting flow velocity and relative position of the platform, it was possible to reach growth rates of the tubes in the order of 0.1 cm in 20 days. Nevertheless, in small test tanks, turbulent and geometrically complex flows (related with the multiple reflection/diffraction effects induced by the glass walls) around the platform and above the reef fragment created protected and calm sectors during severe artificial storms as well. Tubes developed on the reef fragments in an unnatural, horizontal direction. On the substrate, irregular, mainly horizontal, and fragile tubes developed with high growth rates (about 5 cm in 20 days). This configuration showed that the worms had a good persistence in the test tank (more than 4 months) if the original structure of the tubes has been preserved: reef growth can be realized but occurs with irregular rates and geometries that are not representative of the natural conditions.

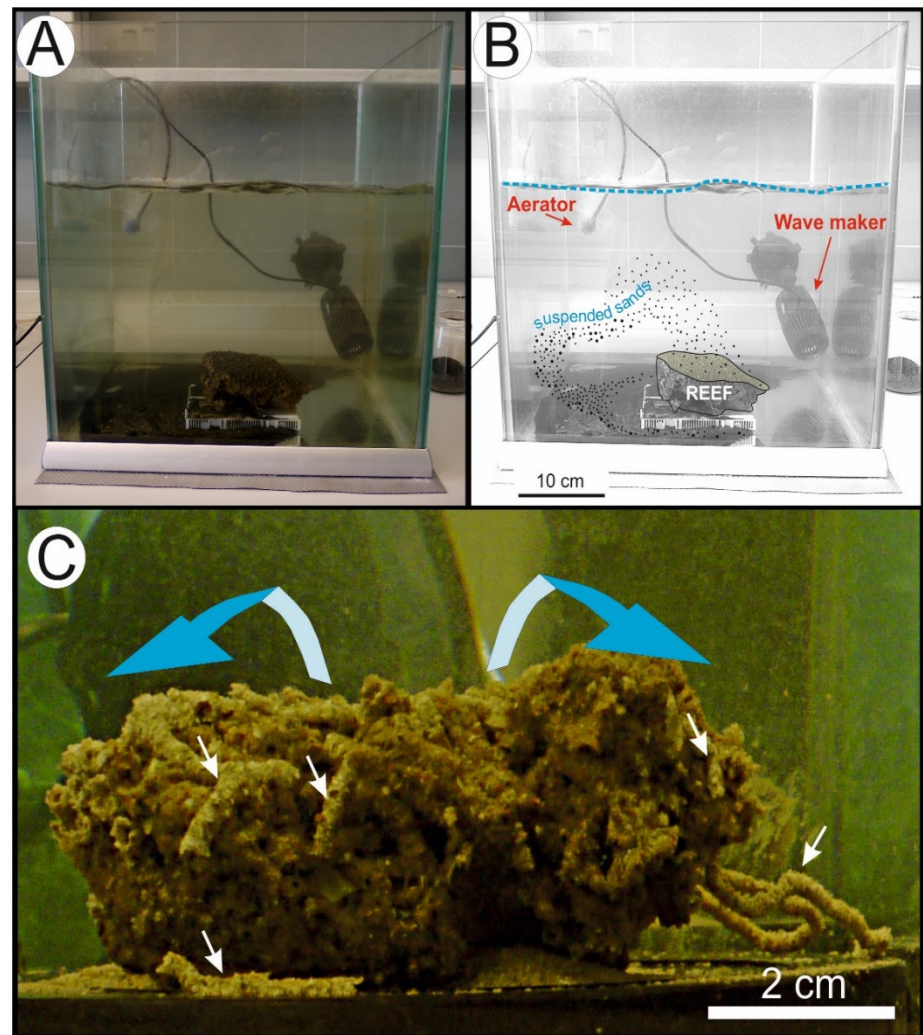


Figure S1. (a) Configuration of the test tank during the second experiment. (b) Diagram of the test tank that highlights the flow of suspended sand around the reef sample, which is generated by the device consisting of an aerator and wave marker. (c) Tubes grown in the test tank during the second experiment.