Recovery of a symbiotic soft coral *Sinularia heterospiculata* after a heat stress

Anastasia A. Egoraeva, Tatyana V. Sikorskaya, Ekaterina V. Ermolenko, Andrey V. Boroda

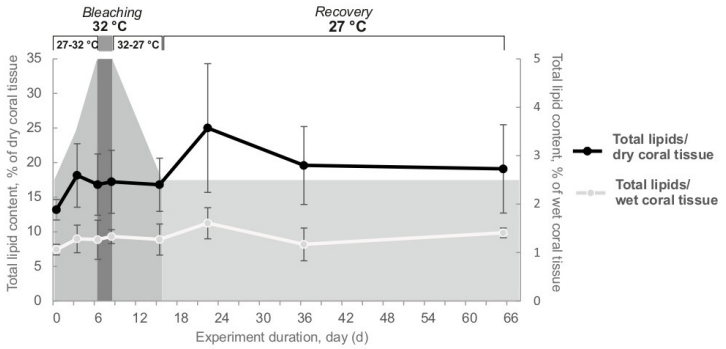
A. V. Zhirmunsky National Scientific Center of Marine Biology, Far East Branch, Russian Academy of Sciences, Vladivostok, Russia

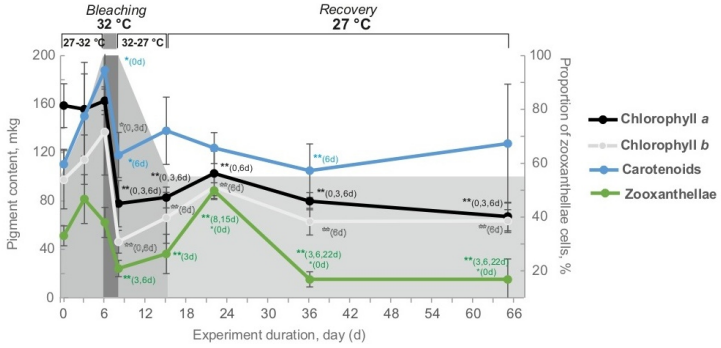
Sinularia heterospiculata

Corals are symbiotic animals whose tissues contain intracellular dinoflagellates or zooxanthellae that carry out photosynthesis and provide the host organism with nutrients it needs. Stressful environmental conditions result in photo-oxidative stress, which triggers the initial stages of coral bleaching. Moreover, when the host coral is exposed to adverse conditions, disturbances occur also in its tissues, which destroys the symbiotic relationships between the partners. This depriving it of the main source of vital nutrients.
he coral restoration research is of high priority for the conservation of coral reef ecosystems. The study of lipid changes in the coral organism during bleaching and subsequent restoration after stress will extend our knowledge about the functioning mechanisms of cell membranes in corals and their endosymbionts.

Sinularia heterospiculata

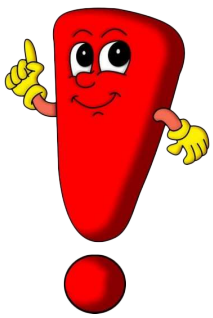
As part of the study, the patterns of changes in lipid contents, number of symbiotic dinoflagellates, and contents of photostatic pigments (chlorophylls a, b, and carotenoids) of the soft coral *Sinularia heterospiculata* were assessed.





None of the experimental colonies showed significant changes in the total lipid content over the experimental time course (HSD test, $p > 0.5$).

After the colonies were heated to 30°C, the proportion of carotenoids and chlorophyll b significantly increased from (HSD test, $p < 0.5$). Further heating induced a reduction in the levels of chlorophylls a, b and carotenoid after a two-day exposure. During the recovery period, the levels of chlorophylls and carotenoids remained unchanged.
A decrease in the number of zooxanthellae cells was observed immediately after two days of heat exposure. After the next 14 days of recovery (27 °C), the proportion of dinoflagellates decreased and remained unchanged until the end of the experiment.



As a result, the amount of chlorophylls a and b decreased. The number of carotenoids increased relative to their proportion in hosted symbionts, which is probably associated with the complementary function of carotenoids as antioxidants. Due to the reduced photosynthetic activity of dinoflagellate symbionts, their restored population could not fully meet the demands of the coral for nutrients. Subsequently, the contribution of heterotrophic nutrition increased in the soft coral, which allowed it to maintain its vital functions, as evidenced by the stable level of lipids.