A combined physical, ecological and transcriptomic approach to detect and predict responses of intertidal organisms towards global climatic changes

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With the increasing of anthropogenic activities world wide, the climate of our earth is changing. Such global climatic change is expected to impact global ecosystems and biodiversity. In the marine environment, intertidal species (including barnacles, limpets and gastropods) are living close to their physiological limit, due to the extreme environmental stressors from tidal inundations. As a result, intertidal communities are highly susceptible to climatic changes. However, we still do not know very well on how species will respond to climate change and which species will suffer more or even extinct in the future. To further investigate how intertidal species to respond to the climatic changes, we need to examine the level of heat stress at the level of organisms and also examine any genetic adaptation of organisms can happen to tolerate the increased heat stress due to climatic effects. In the present study, we deploy bio-mimic temperature loggers, including 'Robo-barnacles' and 'Robo-limpets' on intertidal shores of Taiwan to show how these intertidal organisms experience the heat stresses at long term temporal scales. Bio-mimic loggers composed of 'i-button' temperature sensors embedded into the shells of barnacles and limpets, to simulate the level of heat stress experienced by the organisms. We compared the diurnal temperature variation of these Robo-barnacles and live animals and proved that these Robo-barnacles can reflect the body temperatures of live intertidal organisms. Results from Robo-barnacles showed that the most stressful period on intertidal shores are around the noon periods on sunny days with day time low spring tides in summer. At the level of genetic approach, we have conducted transcriptomic analysis on a high shore barnacle *Tetraclita* and a low shore barnacle of the genus *Amphibalanus* to identify any genes that can have their expression level related to heat stressors. We further use Real-time PCR to examine how the change of gene expressions of the heat related genes (Heat Shock Protein 70 and Heat Shock Protein 90) of high shore and low shores barnacles during the daytime low spring tides on natural shores. We found that *Tetraclita* have faster respond to trigger the Heat Shock Proteins when experienced heat stressors. We predict that low shore species have lower ability to tolerate enhanced heat stressors in the future and can be more susceptible to be impact by Global climatic changes.