Operative temperatures, thermal tolerance and heat hardening responses of the razor clam *Sinonovacula constricta*

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**Data-general information:**

All date were collected from April 2019 to April 2020 in Xiamen, Fujian Province, China (24.6oN, 118.3oE).

The file FEDongST1 contains mean operative temperatures for the razor clams collected in the mudflat at May, June, August, September, November and December 2019 and March, April 2020.

Method: Three roboclams (biomimetic temperature recorders simulated the morphology of *S. constricta*) were made using empty shells of *Sinonovacula constricta* that contained iButtons (DS1922L, Maxim integrated, USA) and vulcanized rubber (No.2131, Minnesota Mining and Manufacturing, USA) and were employed to assess *in situ* operative temperatures experienced by clams in the mudflat. These roboclams were anchored to three plastic pipes and the pipes were placed in a mudflat (24.6oN, 118.3oE) to bury the roboclams at the locations that were naturally inhabited by *S. constricta* (10-20 cm under the surface of mudflat), from April 2019 to April 2020.

The file FEDongST2 contains the Arrhenius break temperatures (ABT) and flatline temperatures (FLT) of razor clams with or without heat hardening responses in June, September and December 2019 and April 2020.

Method: To measure the heat tolerance of *Sinonovacula constricta* with seasonal acclimatization and heat hardening, clams were obtained from a natural mudflat in Xiamen, Fujian Province, China (24.6°N, 118.3°E) in June (n = 240, mean mass = 13.41 ± 0.15 g), September (n = 240, mean mass = 11.87 ± 0.17 g), December 2019 (n = 240, mean mass = 12.06 ± 0.20 g) and April 2020 (n = 240, mean mass = 11.30 ± 0.14 g). Clams were first given a short acclimation of 3-6 days in aerated seawater at the approximate water temperature of the sampling season, pH of 8.4 and salinity of 28 psu with a stocking density of about 20 individuals per tank and natural photoperiod. After the short acclimation, initial heat stresses were conducted by heating clams in 250 mL beakers (one individual per beaker) filled with mud that was obtained from the sampling field (pre-sifted through a 40 mesh and with ~40% water content) at a heating rate of 0.1°C min-1 using a controllable water bath (TFX200, Grant, UK). Temperatures were raised to 33°C, 35°C, or 37°C, respectively, except for Dec 2019 samples that were exposed to 31°C, 33°C, or 35°C, respectively. Maximum temperature was maintained for one minute at the end of heating. These temperatures were based on similar gradient temperature differences to thermal lethal limits of clams in each season. Twelve clams were heated at a time and temperature in the mud was monitored by a temperature sensor (54-Ⅱ, Fluke, USA). After heat stress, clams were allowed to recover from high temperature exposure by immediately returning them to their initial short acclimation conditions for 3 h, 12 h or 24 h and then they were used for cardiac performance measurements. Each group (one initial heat stress with one recovery period) included 24 clams in each season.

Cardiac performance was measured using a non-invasive method as described by Dong and Williams (2011). Briefly, the infrared heart beat signal was amplified (AMP03, Newshift, Portugal), filtered, smoothed, and recorded with a PowerLab AD converter (16/30, ADInstruments, Germany) and valid data were analyzed with LabChart (v7.2). Clams without initial heat stress were used as controls for each of the four seasons. Heat tolerance of *S. constricta* was indicated by the Arrhenius break temperature (ABT), the sublethal temperature where heart rate increases with rising temperature but then drops rapidly, and flatline temperature (FLT), the lethal temperature where heart rate drops to zero. ABT values were calculated by segmented linear regression using Origin software (OriginLab Corp., USA).

**Data-specific information:**

All the case number, units are labelled in the files.