The use of heart rate monitors to determine the effects of environmental stressors in the common shore crab (*Carcinus maenas)*

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Introduction

Wildlife monitoring has always been important for well being of species and environmental changes. Marine environments are at particular risk to anthropogenic actions with benthic invertebrate populations being key to health monitoring due to their abundance, bioaccumulation, and location to pollution outlets. Cardiac responses from these organisms are a useful way of showing the impacts.

Aims and Objectives

- Validate the use if these devices on invertebrates
- To utilise the wearables in a free-moving environment
- Allow for low cost, non-invasive and wireless usage

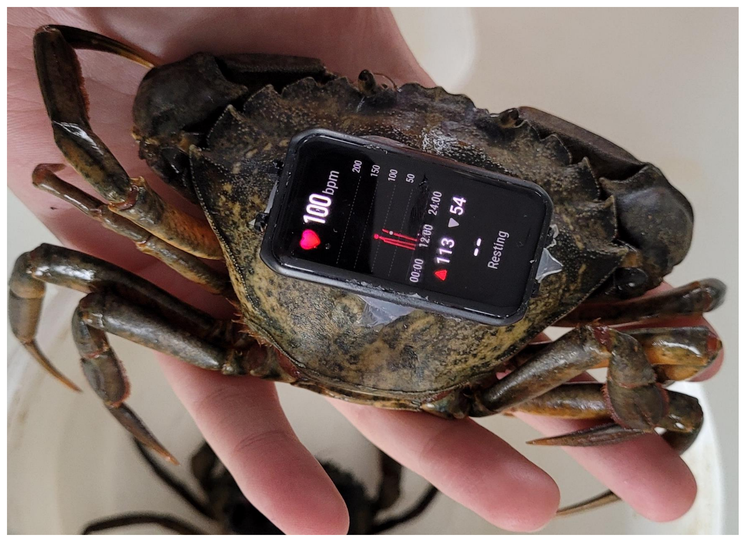

Figure 1: Male crab showing handling stress in the BPM

Materials and Methods

- *Carcinus maenas* specimens were collected from S England
- Measured in width in mm; Small, Medium and Large
- The devices are attached to the dried carapace using silicone craft glue.
- An elastic band may be used to hold the device in place. This is removed after 24 hours and does not effect movement (Figure 2).

Experiments

- 1 hour in, 1 hour out of the stressor, running up to 4 hours.
- Use of water baths and ice buckets
- Handling stress between the two will show in a higher heart rate.
- After experiment is complete, device is left on and returned to outside tank

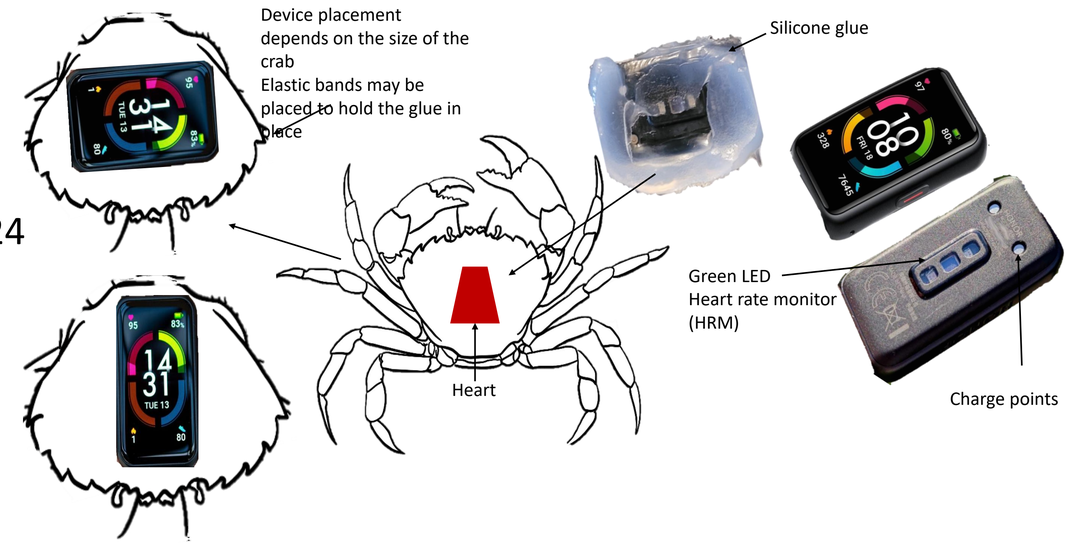

Figure 2: Diagram of device placement

Figure 3: 2 crabs with elastic band fitted devices in the outside tank

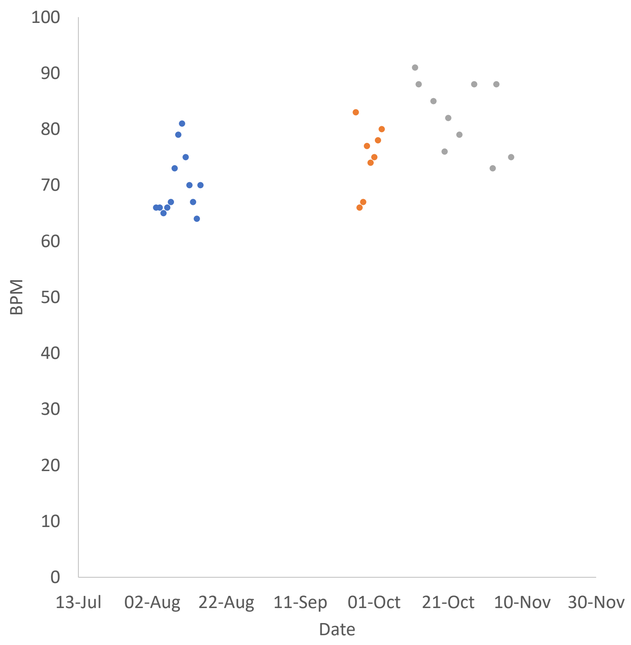

Figure 4: Average HR of 3 large male crabs of orange morphology from August to November

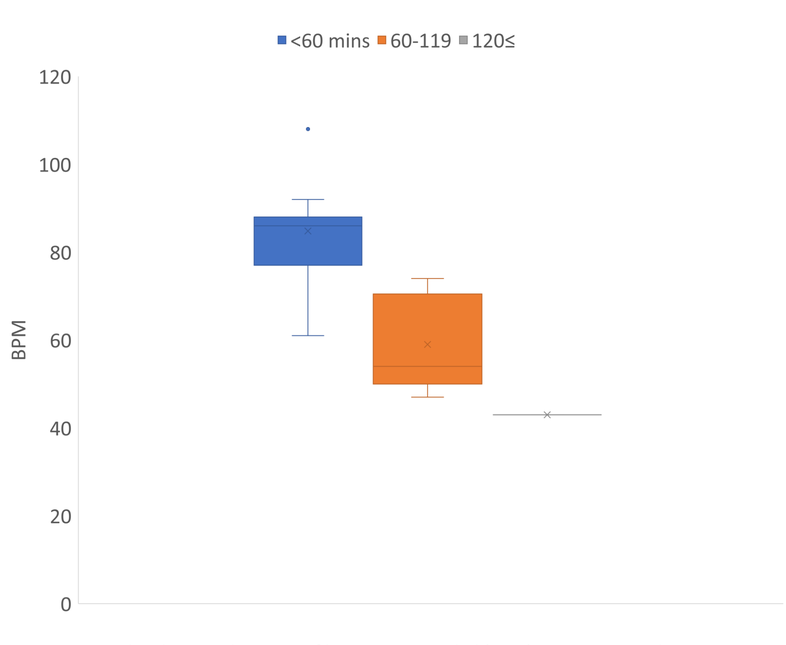

Figure 5: Box plot showing the range of heart rate recorded (BPM) in 3 time periods

Results

An increased heart due to being picked up (handling stress) while the device was being attached (Fig 1). The second image shows device attachment with elastic band in the outside tank (Fig 2).

The average heart rate of 3 different large orange male crabs from August to November. During this times the water temperature has gone from 25 degrees Celsius down to around 20 degrees Celsius. The average heart rate increases gradually as the colder months start with the highest recorded average BPM being 91 BPM on the 12th of October. Devices; 6CD7- Large orange male (75mm), 6046- Large orange male (65 mm), 62FC- Large orange male (67mm). 5 crabs of various size, sex and colour were involved, being placed in ice for an hour then placed back into cool seawater and repeated for approximately 3 hours. The outlier data point was due to handling stress at the beginning of the experiment. The BPM decrease over the time spent in the ice (Fig 4 and 5).

Discussion and Future experiments

- Preliminary results compared to past research are similar
- Average resting heart rate is between 54 to 70.
- Current use of devices is promising while submerged
- Continuing preliminary experiments
- Further experiments with different stressors being planned
- Current experimental methods being adapted and improved
- Field experiments being in discussion but in the far future

Figure 6: water baths

References

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