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Authors: Petr Císař, Mohammadmehdi Saberioon, Pavel Kozák, Aliaksandr Pautsina



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## **Fully contactless system for crayfish heartbeat monitoring: undisturbed crayfish as bio-indicator**

Petr Císař\*, Mohammadmehdi Saberioon, Pavel Kozák, Aliaksandr Pautsina

University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Zátiší 728/II, CZ-389 25 Vodňany, Czech Republic

\*Corresponding author: cisar@frov.jcu.cz

### **Highlights:**

- Novel contact less crayfish heart beat monitoring system has introduced.
- Developed system can provide accurate information on crayfish's heartbeat.
- Developed system can be used as a bio-monitoring of changes in water quality.

### **Abstract**

The crayfish is widely accepted as very sensitive and fast bio-indicator of changes in water quality. Studies based on heart beat analysis demonstrated the potential of using crayfish as a detector of pollutants consequently several computer-aided systems were developed to use this mechanism. The main complication with applying such a system is the necessity of using metal wires or optical fibres to transmit the signal from sensor which is placed on back of the crayfish to the processing hardware; these attachments restrict system design to one crayfish in one aquarium. We introduced an original system for crayfish heart beat monitoring based on completely non-invasive/contactless hardware. The system can determine crayfish heart beat frequency using only the combination of near infra-red (NIR) illuminator and sensitive camera. The heart rate is the only parameter needed in most of the studies using crayfish as a bio-indicator. We developed the system which needs no attachment, so more crayfish in one aquarium can be monitored simultaneously and it provides accurate information on heart rate and crayfish need no adaptation to the system. It can be used as equivalent to existing systems to simplify the crayfish studies.

**Keywords:** Crayfish; Bio-indicator; Heart rate; Contactless; Non-invasive; Water quality

### **1. Introduction**

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