COMPUTERIZED IMAGING TECHNIQUES FOR FISH TRACKING IN BEHAVIOURAL STUDIES

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Introduction

The knowledge of animal behaviour is important to determine optimal rearing conditions and improve the design of aquaculture facilities. The interpretation of the animal attitudes is often subjective. To avoid possible misunderstandings or different interpretations by the observers the parameterisation and quantification of these attitudes is necessary. Fish tracking in the tank could provide information about the position, feeding activity, daily cycles, use of rearing volume, or preference for a specific area into the tank.

In this work computerized imaging techniques were evaluated for the identification and tracking of fish in the tank.

Materials and methods

Two different identification techniques were performed: (a) tracking of fish body (MT): identifies the body morphology of the fish as a particle by contrast with the colour of the tank bottom once illuminated and (b) tracking of a fluorescent fish mark (FT): identifies a fluorescent external mark on the fish under blue lighting conditions

The identification experiment was conducted in a 100*40*10.5 cm^3 transparent methacrylate tank Water recirculation was kept constant at 440 l/h. A group of 6 goldfishes (*Carassius auratus L.*) mean weight, 15g; and mean standard length, 7 cm, were placed in the tank at least three days for its adaptation to recirculating water flux and light conditions.

During the FT procedure fish were anaestheziated (MS-222). A biocompatible and fluorescent small ball of a polymeric clay material was attached to a commercial plastic streamer tag for its identification under blue lighting conditions. Two other marking techniques were performed by subcutaneous injection of fluorescent acrylic paint and elastomer. Marking times, retention of the mark and mortality during the experiment were evaluated (Reig *et al. 2003)*

For both MT and FT a tracking ratio R (number of particles identified in each frame related with total number of particles in the region for tracking) was determined.

Another group of 15 goldfishes (*Carassius auratus L.*) mean weigth, 6g;and mean standard length, 6 cm, were placed in a similar tank 100*40*5 cm^3 with two tangential inlets, at two different water recirculation: 214,77 l/h and 52,77 l/h in order to determine the effectiveness of the identification techniques for behavioural studies. The experiment was video recorded (Panasonic AG-7350) during the feeding period (feed were added for the right side of the tank) and out of the feeding period.

After recording with a CCD camera (COHU 4912) the tank, images were captured with a frame grabber (Data Translation 2861). Fish tracking was done with an specific software (DIGIMAGE) after a particle configuration for each method: a/MT: particle size 50 to 800 pixel, and threshold 180 to 254 and b/ FT: particle size 10 to 100, and threshold 30 to 254.

Results and discussion

Both FT and MT methods are useful tools for the identification and tracking of the fish with a maximum tracking ratio of R= 0.74 for the MT and R= 0.74 for the FT, that can still be improved by changing experimental conditions In the first technique fish are not disturbed, and therefore behaviour remains unaffected. But problems may arise depending on the species (i.e. flatfish).

In the FT procedure, lower marking times but higher retention of the mark and higher tracking ratio were obtained with the polymeric clay marking technique. The FT can be performed with any species with a higher accuracy. But lighting conditions, stress and marking procedure could induce abnormal behaviour patterns.

Using a tangential tank with a flow pattern characterized by Oca *et al.* (2004), the MT tracking method showed how fish preferred low velocity regions but during the feeding period they were located in the right side of the tank where the feed was added.

Conclusion

Computerized imaging technique is a useful tool to determine and to quantify behavioral attitudes during feeding activity at different water recirculation. Further experiments are being performed in order to characterize behavioral patterns for different species at different tank configurations.

References

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