VERSATILE APPLICATION OF RFID TECHNOLOGY TO COMMERCIAL AND LABORATORY RESEARCH CONTEXTS: FRESH FISH SUPPLY-CHAIN AND BEHAVIOURAL TESTS

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Abstract – RFID is an innovative information technology that allows the ability to attain massive amounts of data. It can be used for traceability of good trough the different production stages as well as in behavioural sciences to identify different animals within a group. In this work we summarized two different sectors where this system could be developed. The first concerning the application of such technology to fresh fish supply chain, the second concern a laboratory application for the study of behaviour in laboratory held crustaceans of commercial importance (i.e. the Norway lobster, Nephrops norvegicus). The presented application of RFID to fresh fish supply chain consisted in the application of RFID tags along the fresh fish supply-chain of high commercial value. In the laboratory, a system of distributed architecture made by a microcosm tank with set of RFID controllers below it, each handling a group of seven readers in order to contemporarily portrait the behaviour of up to four individuals.

Keywords – RFID, fish supply chain, Laboratory applications, Nephrops norvegicus, Burrowing rhythms

INTRODUCTION

RFID is an innovative ICT tool that allows the ability to attain massive amounts of data related to products, supplies, inventory, customer service, and machinery. Basic RFID system is composed by an antenna, an integrated circuit, a reader that gathers information from the id tag, and finally by a database system that is used to store the information gained through interrogating the id tag [1]. RFID technologies have gained significant interest from supply-chain industries and academics in recent years [2]. Tags advantage consists in its memory storage capacity, saving data in relation for example to the product identification number, price, cost, characteristics, manufacture date, location, and inventory on hand. The traceability of fresh food chain, such as the fish one has become crucial, challenging and important to keep fish product safety due to a high number of product variants, strict traceability requirements from the customer and the need for temperature control in the supply chain [32].

Marine RFID laboratory applications are scant for technical difficulties of propagating radio waves within the marine medium. Anyway, radio tracking devices can be used to quantify several traits of animals' behaviour, with potential application to marine organism of commercial interest.

Although the RFID is an ICT tool well developed, the potential applications of this technology are already to be investigated inside specific niche sectors in term of efficiency, efficacy and economic sustainability. In this context, we tested the RFID technology in two very different sectors: the fresh fish supply chain and the laboratory, with behavioural tests with groups of commercially important crustaceans (the Norway lobster, Nephrops norvegicus).

MATERIALS AND METHODS

The application of RFID technology was experimented on the fresh fish supply-chain. A total number of 8 fish (> 1.5 kg each) of 5 different species of elevate economic value (Merluccius merluccius, Euthynnus alletteratus, Dentex dentex, Sparus aurata, Trigla lucerna) was tagged on the operculum and followed along the supply chain. The tags used was RFID HF 13,56 MhZ with unique identification data and rewritable memory. An encoding and inquiring unit for RFID tags (Psion Teklogix WorkAbout Pro G2) and a desk read/write unit (MB50) linked to a portable PC via USB was used. The information (time, place, species, additional information) linked to each single fish/tag was recorded along the supply-chain on the fishing boat, local fish market and fish shop.

Laboratory tests were conducted under 12-h light-darkness cycle (10 Lux) in a microcosm tank (150 x 70 x 30 cm) recreating the habitat medium of Nephrops. Four adults were tagged on their telson by a passive RFID transponder (13.56 MHz). A distributed system made by 6 controllers each receiving the signal of seven antennas was connected to a PC storing the spatial information on animals positioning by minute.

RESULTS AND DISCUSSION

The application of passive RFID tags on fish opercula evidenced the necessity to engineer a specific system to tag fish of large size in an easier and firm way. Along all the supply-chain, tags have been always readable; difficulties of reading were found in relation with the proximity of tags with readers. Information archival on a database resulted efficient and useful also for a potential evolution through a shared web-based system with all the supply-chain. The economic sustainability resulted positive only for fish with high commercial value raising also the satisfaction of both consumers and intermediate users.

We observed a variable nocturnal activity across days in the tested animals. Total activity varied over consecutive days. We also observed inter-individual differences in expressed overall activity. Those behavioural differences across-days in the same animal or among different animals within the same test group could be ascribed to the presence of strong territorial aggressive behaviour.

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