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Publisher's version / Version de l'éditeur:
https://doi.org/10.1007/11502593_36
Distributed Computing in Sensor Systems: First IEEE International Conference, DCOSS 2005, Marina del Rey, CA, USA, June 30 – July 1, 2005. Proceedings, Lecture Notes in Computer Science; no. 3560, pp. 399-400, 2005

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June 2005

* published in Proceedings of 2005 IEEE 1st International Conference on Distributed Computing In Sensor Systems (DCOSS-2005). June 30 – July 1, 2005. Lecture Notes in Computer Science, Springer-Verlag, v3560. pp. 399–400. NRC 48302.

Canada

Wireless Sensors: Oyster Habitat Monitoring in the Bras d'Or Lakes

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Abstract. In 2002 a devastating oyster parasite (MSX) was found in the Bras d'Or Lakes of Cape Breton. Environmental parameters affecting the transmission and life cycle of MSX are not well understood. However field observations so far indicate temperature and salinity are critical. Wireless sensor technology can provide robust, reliable and near real time field data collection of such parameters. This paper addresses an implementation of wireless sensors for the timely and cost-effective monitoring and dissemination of bio-physical parameters of interest in the Bras d'Or Lakes.

1 Introduction

In 1957, the oyster population in Delaware Bay was devastated by a protozoan called MSX (multinucleated spherical X, now known as *Haplosporidium nelsoni*) [3]. Approximately 80% of the oyster population dies after initial exposure to this parasite, and after two years, mortality is closer to 95% [2]. By the mid-1990s, it had spread from Florida to Maine [4]. In 2002, it was discovered in the Bras d'Or Lakes. Prior to this, there were no known cases of MSX in Canada. Oysters from the Bras d'Or Lakes have historically been moved throughout Atlantic Canada with the activities of commercial aquaculture. The lifecycle of this parasite is not understood. Laboratory transmission experiments of MSX have been unsuccessful, and eradication of this parasite has not been possible [3]. Field evidence indicates that temperature and salinity are factors in the development and transmission of the parasite [3]. Temperature is one possible method for management of this parasite since oysters in aquacultural endeavours can be positioned in the water column where the temperature inhibits MSX.

The Bras d'Or Lakes, lying between severely glacially weathered cliffs rising to elevations of about 200m, form a brackish inland sea, open at both ends to the Atlantic Ocean. Bathymetric measurements indicate depths to 180m. The shallow (less than 10m) shoreline environment preferred by oysters is generally accessible and ideal for testing innovative biological and oceanographic monitoring solutions.

This monitoring is an imperative first step to understanding the life cycle of the MSX parasite and so a suitable, cost-effective, robust and reliable data collection technology is needed. Wireless sensor technology is one such technology which provides near real-time data collection capability using a mesh topology [1]. Wireless sensor technology also can make use of existing infrastructure such as the cellular network and the high-speed wireless (802.11/WiFi) that may be available nearby to share the monitored data over the Internet to the local communities including the First Nations [5] who are actively engaged in scientific investigations of the ecosystem of the Bras d'Or Lakes. Wireless sensor technology can be very robust and reliable through the use of mesh networking that will allow sensor nodes to effectively avoid failed nodes.

Although some commercial-off-the-shelf (COTS) wireless sensor nodes based on Zigbee standard [6] and proprietary technologies are available, it is not clear if any of them would be suitable for habitat monitoring of the Lakes. Hence our investigation will start with experimenting with these COTS radios in the Lakes followed by modeling of the wireless channel presented by the Lakes which will aid in proposing suitable wireless sensor technology. The investigation will also include proposing suitable protocol and hardware architectures that will satisfy the requirements of habitat monitoring in the Bras d'Or Lakes.

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