Abstract—on this work, the performance, configuration and limitations in the field of an acoustic communication system to monitor marine species in artificial reefs has been studied and analyzed. The system described is composed by different hydrophones and acoustic transponders.

Keywords—hydrophones, acoustic communications, monitoring species, species tracking

I. INTRODUCTION
Advances on electronic technologies applied to marine applications have found new possibilities with the increasing offer of new miniaturized sensor and new types of wireless communications systems, which have opened a door to a new generation of distributed smart sensor networks, spatially or geographically disseminated in the environment. This is particularly interesting on these days, when 76% of global fisheries stocks are currently over-exploited or exhausted and with risk of extinction if they are not managed correctly [1]. In order to help prevent this, an adequate fishery management is imperative; therefore there is the need to increase the actual knowledge of the habits of the exploited species. This paper is a contribution to previous works [2-4] in which different technologies and designs were presented, developed, and tested to monitor and to study the behavior of species. These techniques were developed for their use in laboratories or small aquariums, and present many drawbacks when are used in the field. The strength of acoustic communications technology respect the previous works is the cost and maintenance of the system versus the detection area covered, this is shown in Table 1.

II. OBJECTIVES AND DESCRIPTION
The objective of this work is to study and analyze the performance and configurations of the hydrophones and the transmitters in artificial reefs, where interference problems are present due to the echoes of acoustic signals [5]. The results from this work will be used in a future experimental campaign with green shell crabs (Carcinus maenas), which has the purpose to investigate living habitats. The monitoring system is composed by three transmitters and four hydrophones, located inside and outside two artificial reefs, close to the OBSEA underwater observatory [6], which is located at a depth of 20m. The different experiments - location of the transmitters and hydrophones - make possible this study.

The underwater system is based on Vemco’s commercial equipments. The transmitter is the model “V6”, which operates at 180 kHz. This frequency operates well in the field. The strength of acoustic communications technology respect the previous works is the cost and maintenance of the system versus the detection area covered, this is shown in Table 1.

The location of tag 3 also permits to contrast the performance of detections considering the interferences by the reef.

On the second experiment, the distribution of some transmitters and hydrophones has changed. Here, receptions of hydrophones B and D is tested, in order to evaluate detections of the externals transmitters. On this case, Hydrophones A and C are working well because all of them are inside the range.

Results of different tests confirm also that the position of hydrophones inside closed areas is critical, and in order to improve the reception performance it is advisable to place them as far as possible of the reef walls. These results will be used on an experimental campaign for monitoring species in the OBSEA area.

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REFERENCES

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<td>No</td>
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<td>-</td>
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<td>Yes</td>
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Table 1. Technologies comparison to monitor species