SPERM WHALE (PHYSETER MACROCEPHALUS) ACOUSTIC IDENTIFICATION

Mike van der Schaar, Eric Delory and Michel André.

Laboratori d'Aplicacions Bioacústiques
Universitat Politécnica de Catalunya (UPC)
mike.vanderschaar@upc.edu, http://www.lab.upc.es

Centre Tecnológic de Vilanova i la Geltrú
Avda. Rambla Exposició, s/n
08800 Vilanova i la Geltrú
Barcelona, Espanya

Recordings of a group of diving sperm whales are often made with a small towed array from a boat. This type of array usually does not allow accurate bearing estimation of sources of the received signals, which makes it difficult to separate the whales in the recordings or to identify which animal produced which signal. Additionally, the signals themselves are influenced by sea noise and are strongly directional, both complicating the use of learning classifiers. We present classification results comparing the use of radial basis functions and support vector machines for identification, both using Gaussian kernels. Using features extracted from the signals with a local discriminant basis, these classifiers were able to distinguish between seven whales for the duration of a click train with 80% accuracy. Support vector machines showed best generalisation towards an entire dive for one whale, using only a small segment at the start of the dive for learning, with an accuracy of 79%.

DATA AND IMAGE ACQUISITION SYSTEM TO MEASURE EMERGENCE ACTIVITY RHYTHMS ON NEPHROPS NORVEGICUS POPULATION ASSESSMENT

David Sarriá[1], Joaquín Del Río[1], Antoni Mànuel[1], Jacopo Aguzzi[2], Francesc Sardà[2]

1. Centre Tecnològic de Vilanova i la Geltrú (SARTI),
Rambla de l'Exposició s/n, 08800 Vilanova i la Geltrú, Spain
2. Institut de Ciències del Mar. CSIC
Passeig Marítim de la Barceloneta 37, 08003 Barcelona, Spain

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Introduction

The Norway Lobster, Nephrops Norvegicus (L.), is a decapod crustacean inhabiting of complex burrow systems in the muddy continental shelves and slopes of the Atlantic and Mediterranean Europe. These species are fished intensively in the Mediterranean and they are showing signs of overexploitation.

The project objective is a system design for CSIC marine biologists group that measure the emergency rate of the Norway lobster and permits characterize this specie studying different modulation variables like sex, size, food presence, isolation or coexistence in group.

Since the animals are only captured when they are outside the burrows, the estimations of the biomass populations of this important fishing resource are unknown, to be able to determine and to quantify what number from the population emerges and which are the causes constitutes the biological purpose.

Twelve aquariums with artificial burrow properly equipped and prepared were developed to mount the system and extract the behavior of isolated Norway Lobsters (one by aquarium).

System desing

The solution to detect presence in aquatic surroundings without using wiring inside the acuariums and not to induce stress to the Norway lobster has been using infrared emitters and receivers [1] outside the aquarium (the infrared wavelengths are not detected by Nephrops [2-3]). They are placed forming detection vertical barriers and positioning them in strategic zones allows to detect the step and location of the Norway lobster in the aquarium.

An innovative and customized acquisition system has been developed that is able to acquire up to 64 photodiodes incorporated in each of the twelve aquarium tanks. The infrared signals of each aquarium are acquired by a low cost microcontroller with an integrated AD converter [4] and sent to the host computer using USB protocol [5].

Another developed subsystem controls the day light photoperiod and illuminates the aquarium from above with IR and blue light (480nm) [3].

A low cost USB infrared camera complements the system and permits to view each aquarium in darkness. Applying vision algorithms [6] is possible to confront the results obtained with infrared sensors.

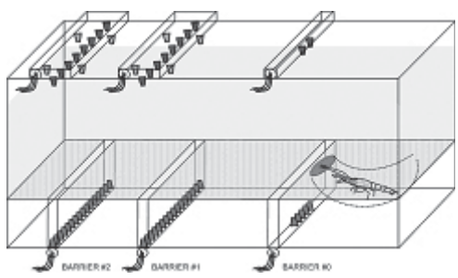

Fig. 1. Assembly of infrared barriers in one aquarium tank

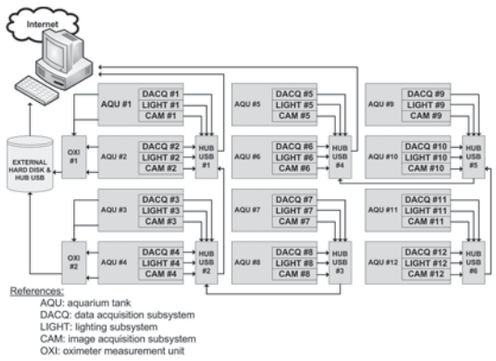

Fig. 2. Complete system structure

A laptop cumputer with a LabVIEW application developed [7] controls all the subsystems and stores IR signal and image data, also treats and processes the data applying a detection algorithm that uses an adaptative threshold to improve results. Finally a remote server application permits control the system and visualizes the experiments through Internet.

Results

Six successful experiments have been done up to the present and processed data is being analyzed by the biologists. These investigators are finding enlightening results of the emergence activity biorhythms of the Nephrops Norvegicus useful for their research and will be published in a near future. The first conclusions during the first analysis are that activity is noticeably nocturnal and the same behavior is repeated day after day following a pattern.

Conclusions

A distributed system has been developed, this design offers great flexibility and is easily expandable; it is enough repeating the subsystems necessary and connects them to the central computer throught USB ports. Two were the interfaces that adjusted to this design: USB and Ethernet, we implemented with the first one because gave more versatility and using the bus power lines avoid external power supply for each device.

Multiple cameras image acquisition is not supported by the software driver NI-IMAQ for USB Cameras for LabVIEW. This problem we have solved with Matlab and the image acquisition toolbox. Since is possible to call Matlab scripts from LabVIEW we have integrated all the interface, system acquistion control and data treatment in LabVIEW. At the moment only the images are stored, we are working for a vision alogrithm and a subtract of equidistant images are giving hopeful results and will permit to contrast and complement the results already obtained with infrared barriers.

Is important to indicate that the system can be used in other biological experiments solving and offering a nonexistent technology in the market.

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COASTAL DYNAMICS INSTRUMENTATION IN THE BASQUE COUNTRY REGION

J. Mader, A. Fontán, L. Ferrer, M. González and Ad. Uriarte

AZTI-Tecnalia, Unidad de Investigación Marina, Herrera Kaia, Portualdea, 20110 Pasaia, Gipuzkoa, SPAIN, e-mail: jmader@pas.azti.es

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One of the main objectives of Operational Oceanography is to obtain organised and long-term routine measurements of the seas, oceans and atmosphere, and provide their rapid interpretation and dissemination [1] [2] [3]. Variables such as marine currents, sea temperature and salinity, wave height and period, wind stress, heat fluxes between atmosphere and ocean are fundamental to get an accurate description of the marine and atmospheric environment, and therefore, bring an efficient Operational Oceanography System on stream. This information can be obtained by means of appropriate instrumentation, which must be of an accurate and robust quality and this requires routine maintenance tasks.

The oceano-meteorological instrumentation network in the Basque Country region (Fig.1) consists of: 1) six coastal oceano-meteorological stations located at Bilbao, Bermeo, Ondarroa, Getaria, Pasaia, and Hondarribia; 2) two offshore buoys (Wavescan), moored off Matxitxako and off Donostia, at 550 m and 450 m water depth, respectively, which provide real time data of the main oceanic and meteorological variables at fixed points, giving reference information for the Basque coastal and oceanic regions (http://www.azti.es; http://www.euskalmet.net).

This study has been focused on data from the pilot coastal station, set up in 2001 in front of the entrance to the harbour of Pasaia (Fig.1). The location selected for the station is a light post which is mounted on a rigid structure attached to the seabed at 25m water depth. Six years time series of meteorological parameters, water temperature and currents over the water column have been processed with specific tools of quality control, statistics and components analysis. In particular, local patterns of currents have been described by studying the correlation between wind and surface currents. The information obtained from surface tracking with a bottom mounted current profiler can be very useful for modelling satisfactory wind driven circulation.