INTRODUCTION

The bottlenose dolphin (Tursiops truncatus, Montagu 1821) is a Mediterranean cetacean listed as "vulnerable" in IUCN Red List. The Ligurian Sea and the Portofino coastal area are subject to intensive boat traffic. This kind of impact represents a serious threat, especially for cetaceans, as they communicate with sounds and orient by underwater sonar-waves. The main objective of the project is the improvement of the conservation status of the bottlenose dolphin in the MPA of Portofino. To facilitate management and conservation policies, to support scientific projects and promote public dissemination, we aim to: create a controlled area; make people aware of the presence of the dolphins; disseminate the appropriate code of conduct among tourists on the Ligurian coast (in accordance with ACCOBAMS and Pelagos Sanctuary guidelines); verify that the given rules are respected.

THE ARION SYSTEM

The detection units are composed by a network of hydrophones installed on two elastic beacons (FIG.2) in front of the Portofino MPA (FIG.1). The acquisition system communicates with an on-shore computer center installed in Portofino’s lighthouse to locate and track dolphins and boats in real time.

GENERAL FUNCTIONING (Figures 3-5):

- 2 couples of hydrophones on each buoy collect underwater sounds
- thermometers and current wave meters collect environmental data
- raw data are filtered and transmitted on shore using a wireless bridge
- dolphin’s whistles and other sound sources are identified in real time
- the position of a sound source (triangulated) is used to generate a track representing the trajectory of the "target" (dolphins or boats)
- raw data are stored for research purposes
- Information resulting from data analysis is transmitted to a web server and made available to the end users

DOLPHINS AND BOATS TRACKING

- Whistle detection by a proper detection function applied to the spectrogram
- Continuous listening of boat engine sound (no detection trigger)
- Direction finding by single acoustic station (detection unit)
- Position finding by triangulation
- TDOA (Time Difference Of Arrival) calculation by crosscorrelation

FIRST RESULTS

TABLE 1. Presence rate of the bottlenose dolphins (E.R.) by ARION System calculated as: number of days with at least one whistle detected (Positive days) / Number of day of monitoring (Total days functioning).

<table>
<thead>
<tr>
<th></th>
<th>Total System</th>
<th>Carega Beacon</th>
<th>Sindaco Beacon</th>
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<tbody>
<tr>
<td>Positive days</td>
<td>49</td>
<td>42</td>
<td>20</td>
</tr>
<tr>
<td>Total days functioning</td>
<td>200</td>
<td>182</td>
<td>97</td>
</tr>
<tr>
<td>E.R.</td>
<td>0.245</td>
<td>0.23</td>
<td>0.21</td>
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FIGURE 7. Number of days with at least one detected whistle analyzed for the ARION system data set (A) and for the data set collected by the Carega Beacon (B) and Sindaco Beacon (C).

FIGURE 8. Bottlenose dolphins detection during the day time.

FIGURE 9. Example spectrogram for all observed whistle types.

FIGURE 10. ARION system data flow