

WHALESAFE FINAL REPORT

ANNEX 16



GUIDELINES AND BEST PRACTISES FOR COLLISION RISK REDUCTION

This document is the deliverable of Action C.13.

CONTENTS

Contents

Introduction	1
The Protocol of Conduct	3
The Detection Algorithm	4
Contacts	6



WhaleSafe



Introduction

The risks of collisions between ships and whales is not negligible and also the Pelagos Sanctuary the presence of commercial ports and heavy marine traffic is not a fully safe environment for the Cetaceans! Only two months ago it has been reported the sighting of a whale without the tail, cut by a propeller (<https://www.ilsecoloxix.it/savona/2020/06/22/news/codamoza-il-viaggio-della-balena-con-la-coda-amputata-da-messina-al-santuario-pelagos-1.38998013>).



Figure 1 - The whale without the tail

It is mandatory to implement best practices to minimize the risks.

During the project, we interacted with the stakeholders and clearly emerged their willing to participate and to adopt procedures that could prevent this kind of collisions. The Protocol of Conduct developed by WHALESAFE and defined with the active collaboration of the stakeholders is a good starting point.

We have not been able to see the application of the Protocol, because the project came to an abrupt stop after the storm of October 2018; nevertheless the Protocol of Conduct contains very simple indications that can be easily adopted by the ships in the area, i.e. visual monitoring, low speed and ban of navigation close to the animal. Moreover, the experience gained during the period when the project was active make us confident of the effectiveness of the proposed Protocol.

However, these indications can be applied ONLY if the position of the animal is known.

Two possible techniques can be adopted: a) active whale watching and b) passive listening to the animal. The first method, adopted for example by REPCET (www.repcet.com) active in the Pelagos Sanctuary, relies on the capability of watchers on board of the ships to visually localize the presence of the sperm whale, mainly at the time of the emersion when the plume make the animal more visible. This technique shows however several drawbacks:

- can be applied only during the daylight,
- the localization can occur in very limited occasions

INTRODUCTION

- since it happens at the moment of the emersion, it could be too late for adopting the correct behaviour (consider that large ships need several minutes to slow down their speed or change the route).

The second method, based on a set of hydrophones, can listen to the echolocation sounds (clicks) emitted by the sperm whale during their underwater activity. This is the method that WHALESAFE implemented. During the duration of the project we verified the following great advantages of this technique:

- it is possible to perform the scan of the sound tracks simply programming a dedicated computer, therefore in principle the role of humans is simply to guarantee the operability of the computer and in general the maintenance of the system;
- the sperm whale is localized during the underwater activity, therefore well in advance the emersion, providing enough time to the boats to adopt the Protocol of Conduct;
- it works day and night;
- the detection range of the hydrophones is several kilometres, larger than the watcher capability; therefore it can easily anticipate the visual localization;
- the system provides the possibility to monitor in real time the movement of the sperm whale during most of its underwater activity, giving to the Coast Guard the possibility to evaluate the risks well in advance

The Protocol of Conduct

The Protocol of Conduct is the reference document for the generation of the alarm. In the document, it is reported that the following four alert levels have been defined:

- **Green** - absence of Sperm whales in the area, free navigation;
- **Yellow** - confirmed presence in the area of at least one sperm whale;
- **Orange** - confirmed presence of at least one Sperm whale on the surface, it is therefore necessary to follow the indications of the Protocol of conduct.
- **Red** - confirmed presence on the surface of at least one Sperm whale and ships on a collision course, it is therefore necessary to follow the indications of the Protocol of conduct.

The "duration" of the **orange** is 15 minutes to allow cetaceans to float in safety, after this time and in the absence of new detections, the traffic light turns **green**. In presence of the **orange** level three areas are defined around the animal as shown in Figure 2:

- **NO-TRANSIT ZONE:** Transit is not recommended within 100 m from the sperm whale.
- **TRANSIT ZONE:** transit is recommended at distance lower than 500m from sperm whale at speed lower than 6Kt.
- **ALERT ZONE:** Within 3nm from the point foreseen for the surfacing of the sperm whale (reported as described in the next paragraph), ships have to keep particular attention by employing observers.

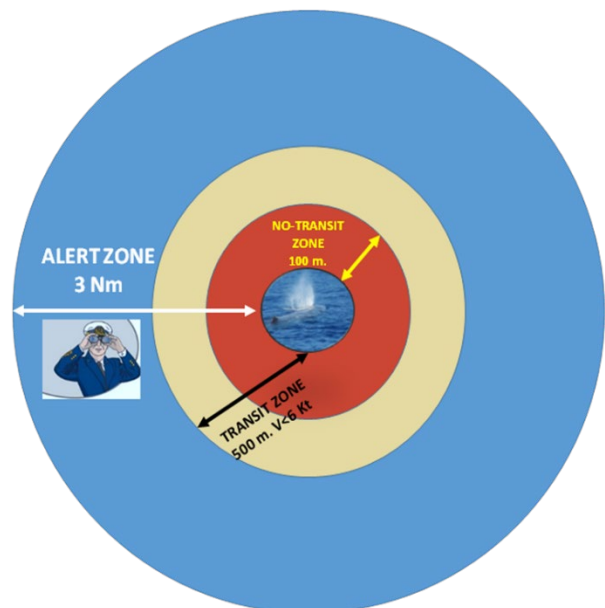


Figure 2 – The three areas defined by the Protocol of Conduct

The levels **yellow** and **orange** are automatically determined by the system, while the setting of the **red** alert is decided by the VTS personnel of the Savona Coast Guard

THE DETECTION ALGORITHM

The Detection Algorithm

The detection unit receives two signals from the sperm whale, the first is the direct sound and the second one is deflected by the sea surface as shown in Figure 3. A computer hosted on the buoy processes the digitized signals and the analysis of the relative time difference between pairs of hydrophones determines the direction of arrival of the sound beam

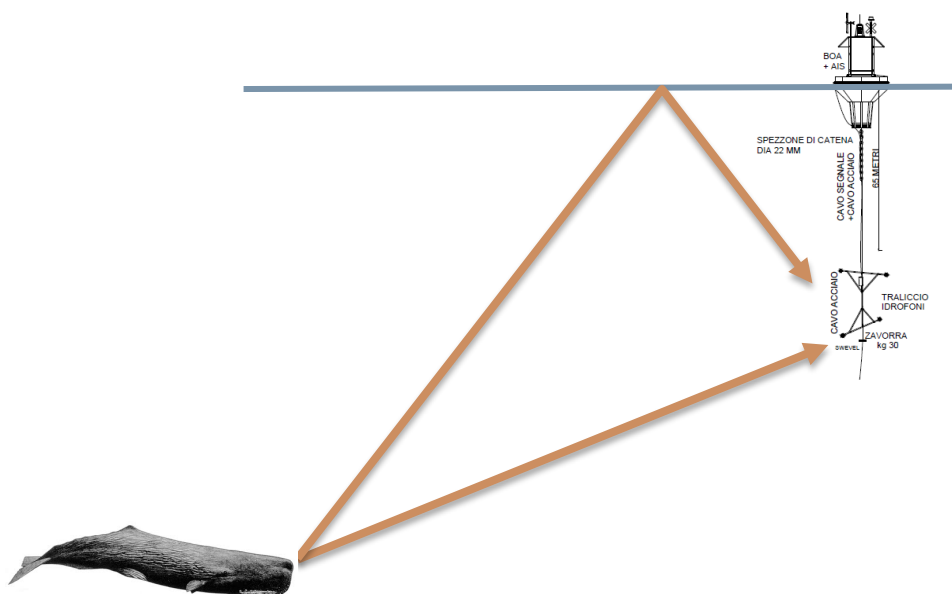


Figure 3 - Path of the sound beams detected by the idrophones

Known the depth of the hydrophones, the direction of the two sound beams measured with respect to the vertical can be used to build a triangle where one side (twice the depth of the hydrophones) and the two adjacent angles (the arrival angles of the sound beams) are known. In this way, it is possible to determine the length of the other two sides and therefore the position of the vertex where the sperm whale is located as shown in Figure 4. Thanks to the GPS mounted on the buoy it is finally possible to determine the absolute coordinates of the animal.



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THE DETECTION ALGORITHM

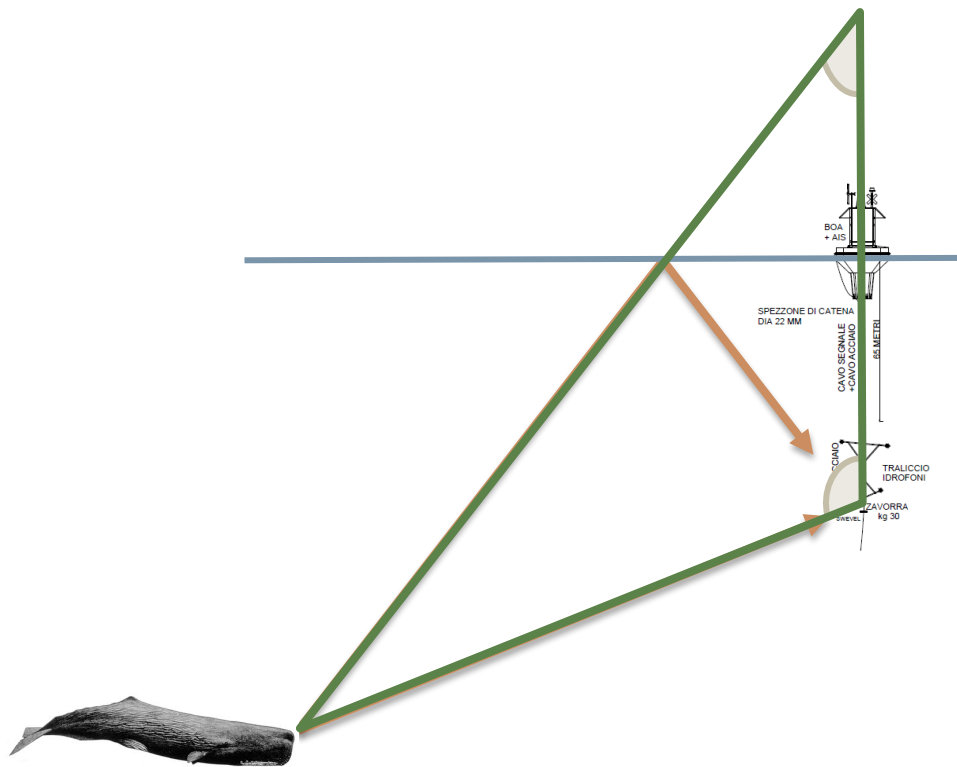


Figure 4 - Relationship between the whale position and the measured angles



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