

Limiting the risks of collision between commercial vessels and large cetaceans



Presentation of the system

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Working together to encourage changes in individual and collective behaviour at a local level.*



IMPORTANT NOTE:

REPCET is a system under development. This document has a pedagogical aim and reflects the current vision of the system designers. Certain aspects, in particular the graphics, will be subject to significant modifications before publication of the first version of the system in 2010.

SUMMARY

Collisions between commercial vessels and large cetaceans are not only a significant threat to whale populations, but also to the security of the vessels involved. The scientific community and navigation companies around the world (in particular in the Mediterranean, North Atlantic, Canary Islands and Japan) are seriously concerned about these accidents.

In response to this problem, researchers, engineers and representatives of maritime transport companies have joined forces to develop an innovative system. REPCET¹ is a collaborative computer system based on the density of the navigation network. Thanks to a computerised network, REPCET allows commercial vessels real-time access to the positions of whales last seen on their navigation routes in order to reduce the risks of collision.

CONTEXT

Since the advent of navigation, marine animals have been obliged to share sea and ocean surfaces with humans. If ships are able to collide with each other in this space, it is also possible for them to collide with cetaceans. Far from being rare, these collisions occur in waters all around the world, and can result in the death of the injured animal. Many whale



populations around the world are known to be under serious threat from the increase in frequency of these accidents. In certain circumstances, navigation companies and their passengers also pay the price of such accidents. One of the most dramatic cases documented was in February 1992 when a jetfoil passenger was fatally wounded after an abrupt “emergency stop” in the Canary Islands, an attempt to avoid collision with a sperm whale. Injuries to people remained negligible until recently (2004–2007) when a series of collisions in Japanese waters involving several different species caused serious injuries to jetfoil passengers, including one fatality.

In the Mediterranean, many collisions with large cetaceans are known to have damaged or destroyed stabilisation apparatus of the vessels involved, often causing leakage and requiring major expensive repairs. On the ecological side, it has been shown that 20% of whales found dead died following collisions in the northwestern Mediterranean sea. In 2001, France, Italy and Monaco signed an agreement creating the Pelagos Sanctuary, a protection zone for marine mammals located between Corsica and the mainland. One of the commitments of the three countries is to encourage the establishment of systems aiming to limit collisions, in consultation with representatives of navigation companies. Conceived and developed in response to this, the REPCET system is currently being expanded and tested in the Pelagos zone. Eventually the system will be applied to all areas where collisions are a known issue (North Atlantic, Japan, Canary Islands, etc)

¹ Real-time Plotting of CETaceans

ESSENTIAL PRINCIPLES

System overview diagram



The REPCET tool is a software system dedicated to commercial navigation. Its aim, first and foremost, is to limit the risks of collision between large cetaceans and commercial vessels.

The concept is simple and is based on the following: every sighting of large cetaceans by watchkeeping personnel on board a vessel in possession of REPCET is transmitted by satellite in semi-real-time to a server located on land. The server then centralises the data and sends out an alert to all equipped vessels likely to be concerned. The alerts are displayed cartographically on a dedicated screen on board.

The collaborative nature of the system means it relies on the density of maritime traffic. Other vessels are also welcome to contribute voluntarily to the system by reporting cetacean sightings, especially any scientists at sea, whale watching operators, or even pleasure boaters.

Input of a sighting

Consideration for the work of watchkeeping personnel on the bridge is one of the keys to the effectiveness of the system. That is why particular attention is given to the ergonomics of user interfaces, especially in facilitating the reporting of whale sightings. The input interface (opposite) thus allows rapid entry of sightings into the system, automatically linking them to various essential data (name and position of the vessel, distance and bearing of the animal, its species, number of individuals, etc). A relative positioning apparatus has been specially designed for this purpose.

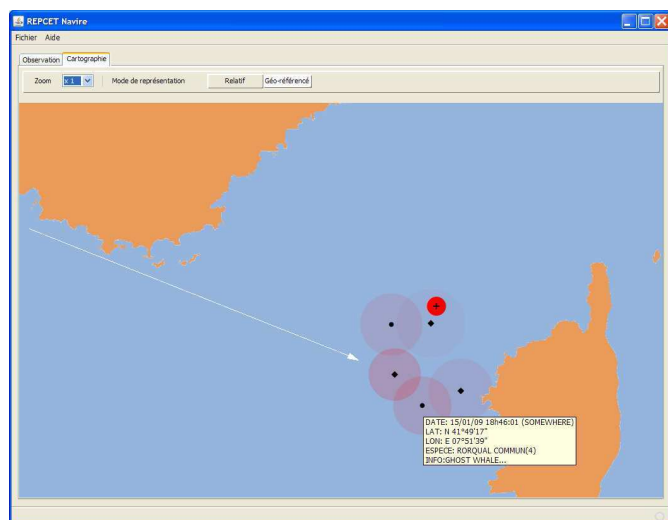
The screenshot shows the 'REPCET Navire' software interface. It has a menu bar with 'Fichier' and 'Aide'. Below the menu bar are two tabs: 'Observation' (selected) and 'Cartographie'. The main area is divided into two panels. The left panel, titled 'Positionnement visuel', shows a relative positioning diagram with concentric circles representing distances from 1 NM to 5 NM and radial lines representing bearings from 0° to 112.5°. A specific sighting is marked at 2.2 NM and 30°. The right panel contains data entry fields for 'Position relative cétacé(s)'. It includes fields for 'Gisement' (30°), 'Distance (NM)' (2,2 NM), and 'Distance (m)' (4150 m). There are also fields for 'PHOCEA' coordinates: 'N 42°29'41"', 'TU 10h33:05', 'E 07°59'23"', and 'Cap 250°'. Below this is the 'Informations complémentaires' section with a dropdown for 'Espèce' (set to 'Rorqual commun'), a 'Remarques' text area, and a 'Nb d'individus' dropdown (set to 1) with a 'Décédé' checkbox. At the bottom are 'Actions' buttons: 'Envoyer', 'Autre saisie', and 'Annuler'.

Presentation of the alerts

The mapping interface is designed to present the alerts sent by the server (see illustration below). It allows the user to visualise the alerts on a topographic map and to easily zoom in and pan around the map. An intuitive display allows rapid location of dangers and their nature, in order to alert the bridge watch, for example. Detailed information on the alerts can also be called up (origin, time, species and number of individuals).

ADDITIONAL FUNCTIONS

Risk zone display



In addition to accurately positioning the whale sightings, the system calculates and displays the associated risk zones (opposite). These shaded circular areas correspond to the initial risk of encountering the detected animal. The display allows intuitive comprehension of the level of risk within the mapped zone. Customisable alarms allow crew members to anticipate potential encounters, thus avoiding the necessity of continuous monitoring of the mapping screen.

After a certain time period, the zone is deemed no longer at risk and the circles disappear. The position of the initial sighting however remains for 24 hours, identified by a different marker. In this way, potentially

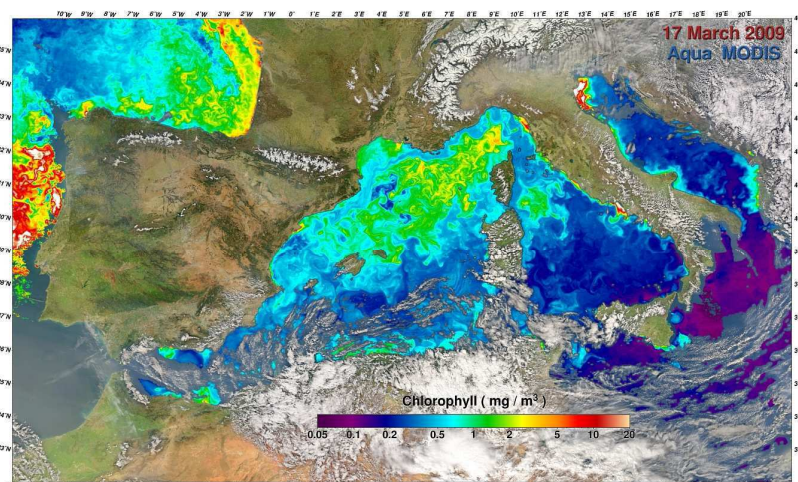
dangerous sectors where recent whale sightings are particularly abundant are easily identifiable.

Alert and display of dangerous floating objects (AVURNAV)

In a collaboration with CROSSMED, REPCET is to be used as an additional means of AVURNAV (emergency alert for navigators) broadcasting. Warnings sent out by CROSSMED are transmitted automatically to the REPCET system, which allows them to be displayed cartographically on board. In addition, the system makes it possible to report dangerous objects to CROSS and to other equipped vessels, with the same user-friendly interface presented above for whales.

Integration of prediction models for cetacean distribution

Cetaceans do not move about randomly in their habitats. Their presence is linked to the abundance of their food source, which in turn depends on physico-chemical and biological factors over distance and time. Based on this observation, statistical models have been developed that predict zones of cetacean presence according to environmental data provided by satellite such as temperature, currents, salinity, and even chlorophyll levels (see opposite).



A collaboration is currently underway with CNRS, integrating an early cetacean distribution model into the REPCET system. The interface is thus capable of displaying high risk zones of whale presence. This experimental approach will be modified and improved as new versions of the system are developed.

Interactive Terminal

The REPCET system may be accompanied by an interactive terminal for the use of passengers on equipped vessels. This pedagogical tool provides an encyclopaedia of Mediterranean cetaceans, as well as displaying the position of recent whale sightings on a topographic map. It encourages the involvement of equipped companies, at the same time providing information to passengers with a public-awareness message on the protection of cetaceans.

Contribution to research

While in use, the system sends the cetacean positions transmitted by equipped vessels to a database on land where they are recorded and linked to meteorological data. This database is made available to the scientific community with a twofold objective to improve our knowledge of cetaceans in order to eventually improve the performance and precision of the REPCET system.



Use of REPCET thus contributes in two ways to the ecological responsibility policies of maritime companies: protecting large cetacean populations against the risk of collision, as well as contributing to research on these animals.

ANTICIPATED DEVELOPMENT

Integration of sensors and computerisation of detections

REPCET is designed to evolve with technology. Relying initially on visual detection in its earliest version, it is designed to integrate all types of sensors (on-board infrared sensors, underwater passive acoustic detection systems, etc.)

Thus in future versions, the system will be capable of automatically processing the positions of large cetaceans detected by these sensors, and as a result optimise the performance of the system particularly at night.

Integration with ECDIS

Steps are being taken to allow REPCET to display ECDIS (Electronic Chart Display and Information System) alerts in future versions of REPCET.

“Marine Area” interface

A web-based interface is envisaged for the use of Marine Protected Area (MPA) managers involved in the development of the system. The interface will allow users not only to monitor sightings of large cetaceans in real-time, but also to browse the history of sightings and develop charts showing the distribution of the animals over time. The aim is thus two-fold:

- a. to provide a logistical tool for research within the marine area (use of real-time data)
- b. to provide a tool for the monitoring of whales seen by equipped vessels (use of mapping history).

PARTNERS

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Logistics partners .



Support



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