

**Limiting the risks of collision
between commercial vessels and large cetaceans**



Presentation of the system

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REPCET V.1***

Souffleurs d'Ecume

Scientific association for the protection of nature
Hôtel de Ville, F-83170 La Celle – www.souffleursdecume.com
Tél. : +33(0)4 94 69 44 93 – pmayol@souffleursdecume.com - SIRET 449 804 319 00035

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



SUMMARY

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

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. Through use of a computer network, REPCET allows commercial vessels real-time access to the positions of whales seen recently 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 occurrences, such collisions occur in



waters all around the world, and usually 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 as a result of collisions in the western basin.

In 2001, France, Italy and Monaco signed an agreement creating the Pelagos Sanctuary, a protected 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 shipping companies. Conceived and developed in response to this, the REPCET system is currently being expanded and tested in the Pelagos zone. The ideal is to eventually expand the system to be applied in any areas where collisions are a known issue (e.g. North Atlantic, Japan, Canary Islands, etc).

¹ Real-time Plotting of CETaceans

MAIN FUNCTIONS

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 equipped with 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 equipped vessels that are likely to be affected. 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 reporting of whale sightings.

The input interface (shown on the next page) 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 tool has been specially designed for this purpose.

Display of the alerts

The mapping interface is designed to display the alerts sent by the server (see illustration on next page). 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 adapt the watch on the bridge, for example. Detailed information on the alerts can also be called up (origin, time, species and number of individuals).

Observation interface :

Map interface :

Risk zone display

In addition to accurately positioning the whale sightings, the system calculates and displays the associated risk zones. These shaded, evolving circular areas (previous illustration) are a function of the ethology of the species in the sector concerned, and correspond to the risk of encountering the initially detected animal. The display is intuitive, allowing the level of risk within the mapped zone to be easily and quickly understood.

Customizable 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 symbol. In this way, potentially dangerous sectors where there have been abundant recent whale sightings are easily identifiable.

Alert and display of dangerous floating objects

CROSSMED has agreed to collaborate with REPCET, which will eventually be used as an additional means of broadcasting emergency alerts for navigators. 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.

Contribution to research

The system sends the cetacean positions transmitted by equipped vessels to a database on land where they are recorded and linked to meteorological data. The database is thus built up over time, and is made available to the scientific community with a twofold objective: to improve our knowledge of cetaceans, AND eventually to improve the performance and precision of the REPCET system.



Use of REPCET thus contributes in two ways to the ecological

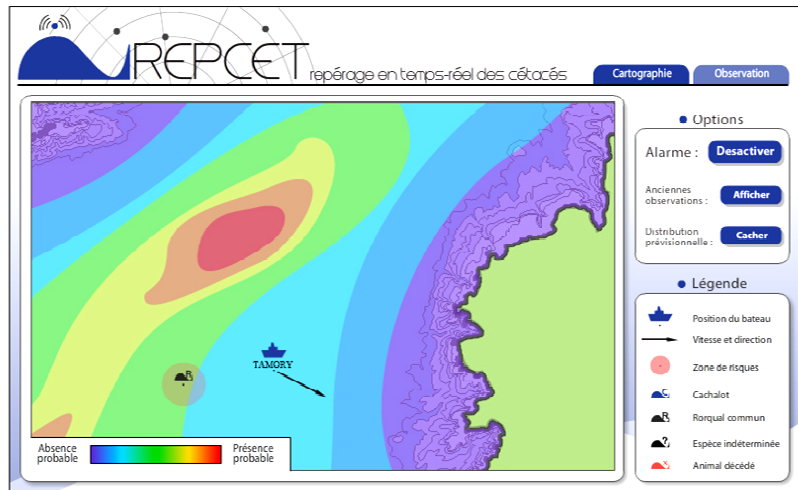
responsibility policies of maritime companies: protecting large cetacean populations against the risk of collision, as well as contributing to research on these animals.

OPEN-ENDED TECHNOLOGY

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 chlorophyll levels.

Collaboration with CNRS is currently underway, to integrate an early cetacean distribution model into the REPCET system. The interface will thus be 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. The figure opposite shows an illustration of the integration of a presence prediction model into the system.



Integration of sensors and automation 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 its performance particularly at night.

“Marine Area” interface

A web-based interface is envisaged for the use of Marine Protected Area (MPA) managers who may benefit from 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: to provide logistical support for research within the marine area (access to data in real-time), as well as a tool for monitoring whales seen by equipped vessels (use of the map history tool).

Interactive Terminal

The REPCET system can be accompanied by an interactive terminal for the use of passengers on equipped vessels. This pedagogical tool provides encyclopaedia-style information on 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.

PARTNERS

Equiped shipowners



La Méridionale

Support



Scientific and operational experts



Logistics partners



PEOPLE AND CONTACTS



**Souffleurs
d'Ecume**

Designers, scientific coordinators
Souffleurs d'Ecume
+33(0)4 94 69 44 93
pmayol@souffleursdecume.com



Manufacturing coordinators, project managers
Chrisar Software Technologies
+33 (0)4 94 25 69 46
bertrand.gadaix@chrisar.fr

Further information at www.repcet.com

Author : Pascal MAYOL, with the contribution of Bertrand GADAIX
Translation: Emma McKenzie