

# Using Big Data and Information Systems Analysis to Improve the Sustainability of Blue Economic Growth: New methods to reduce whale/ship collisions and increase whale watching potential in Europe

## HOSTING LAB

The PhD student will be hosted in UMR Amure Lab, which focuses on the Economics and Law of the Sea. Amure is a joint research team combining UBO/IUEM and Ifremer staff. More specifically, the successful candidate will be associated with the International Chair in Marine Ecosystem Services, held by Dr. Linwood Pendleton.

## PROBLEM STATEMENT

In 2011, European Commission (EC) took strategic steps aimed at supporting and facilitating “smart, sustainable and inclusive” growth of the “blue economy.” Efforts in the European Union (EU) are focused on developing maritime sectors with the highest potential to create jobs, including coastal tourism and maritime transport (EU, n.d. a), but also improving knowledge and raising awareness, as well as enhancing the cooperation among countries under a shared goal. In recognition of the need to undertake such growth sustainably, the E.C. began promoting the Blue Growth Strategy in 2014 as “a long term strategy to support sustainable growth in the marine and maritime sectors as a whole” (European Commission, 2014).

Whale watching has been proposed as part of an invigorated maritime tourism industry. To date, however, the whale watching industry has been hampered by: difficulty in finding whales with high probability, and a lack of enforcement of best practices to ensure the ecological sustainability of whale watching activities. Even in the Pelagos Sanctuary for Marine Mammals™, the world’s first international marine protected area, there is almost no direct enforcement of sanctuary rules because the area is so large and it is so difficult to know where whales and dolphins actually are.

Even while whale watching companies struggle to find whales on a consistent basis, the ever growing maritime transportation industry continues to be a threat for the health and well-being of whales and dolphins, with known whale strikes in the Mediterranean averaging nearly 2 deaths each year of fin whales (the world’s second largest species of whale) (Panigada et al. 2006). Because most whale strikes go unreported, the number of whale deaths due to collisions with ships is likely to be higher. Reduced speeds for maritime traffic has been proposed to reduce whale strikes by ships, but such measures are often met with resistance by commercial shipping interests because it is difficult to identify exactly where ships should slow down and slower speeds results in higher costs for shipping companies and ferry lines.

Ecological habitat models that estimate the probability of occurrence of whale species in a specific location (Druon et al 2012) and whale sighting communication tools (REPCET) have

been developed to provide better information about those areas where there may be high probability of encountering whales. Habitat models provide only a very coarse indication of where whales may be and have been validated using only historical data collected mostly by aerial overflights and citizen science whale watching cruises. Real time tools, such as REPCET, are operational only at a small spatial scale and are limited in the number of observations that inform vessel traffic since observations are only reported by ships that have chosen to install REPCET devices. Neither approach provides the near-real time precision needed to both help whale watchers and sanctuary personnel, and other conservation agencies (e.g. ACCOBAMS) better find whales or for ships and ferries to avoid these same whales.

## **APPROACH**

We propose two doctoral dissertations, one at Institut Mines Télécom Atlantique (IMTA) and the other at Institut Universitaire Européen de la Mer (UBO), both co-supervised by Linwood Pendleton and René Garello/Ronan Fablet. THE CURRENT PROPOSAL IS FOR THE UBO (AMURE) THESIS ONLY.

The proposed doctoral research will build on current ongoing work at IUEM as part of the EU Horizon2020 project entitled ECOPOTENTIAL. The IUEM team, led by Dr. Linwood Pendleton, has worked with marine mammal conservation organizations, the TETHYS Research INSTITUTE, and certified high quality whale watching companies to identify a very wide array of potential data that potentially inform a more “real-time” model of whale distribution and likelihood. These data include very high resolution (VHR) satellite photographs (30cm, provided by World View 3 satellite images from Digital Globe foundation), existing historical data, data from underwater acoustic measurements, social media data (e.g., photographs of whales and dolphins), whale watching trip level sightings data, the most up to date research data (before it has been formatted for submission to routine data repositories which can take as long as 4 years), and a full suite of ocean observations from the *Copernicus* and *Sentinel 2* satellites that may prove critical in explaining whale distribution.

The proposed thesis is designed to estimate the economic, commercial, and socio-economic impact of the proposed use of Earth Observations to better understand the distribution of whales. The thesis will have 4 research objectives:

### RESEARCH OBJECTIVE 1:

Work with end-users to determine what the best ways near-real time, spatial forecasts of whale distribution and probability of encounter that could be used to improve the efficiency and efficacy of whale watching, marine protection, and approaches to reduce ship collisions.

### RESEARCH OBJECTIVE 2:

Conduct an evaluation of the potential socio-economic benefits of improved whale (distribution) forecasting (including estimates of job creation, effects on tourism arrivals, gross revenues of whale watching tourism).

#### RESEARCH OBJECTIVE 3 :

Estimate the potential costs and benefits of improved forecasting for narrowing the spatial expanse of ship “slow down” areas needed to reduce collisions between ships and whales.

#### RESEARCH OBJECTIVE 4:

Estimate the potential costs and benefits of improved forecasting for narrowing the spatial expanse of ship “slow down” areas needed to reduce collisions between ships and whales.

#### **REFERENCES**

Druon *et al* (2012)

European Commission (2014)

Panigada *et al* (2006)

Souffleurs d'Ecume (2016). REPCET (repérage en temps-réel des cétacés) Homepage.

Retrieved 3 January 2017 from: <http://www.repcet.com/accueil>.

#### **COLLABORATION**

Some close collaboration will take place with LabSTICC and other Telecom Bretagne Researchers, including another PhD student. In addition, many interactions and collaborations are expected to be made with socio-economic stakeholders.

#### **VALORISATION**

Working with the Pôle Mer Bretagne-Atlantique and Mediterranee, identify small scale enterprises that can integrate these near real-time models in commercial navigation software.

#### **SUPERVISION AND CONTACT**

The PhD will be co-supervised by Dr. Linwood Pendleton (UBO) and René Garelo/Ronan Fablet (Telecom Bretagne).

Contact for more information: [linwood.pendleton@duke.edu](mailto:linwood.pendleton@duke.edu)