

**TRACK & LOC**

CLS SERVICES

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*Hundreds of pop-up  
and internal tags  
processed*

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# A SERVICE FOR ARCHIVAL TAG DATA PROCESSING & UNDERWATER GEOLOCATION

Environmental monitoring

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# 30 years of worldwide Argos tracking and environmental monitoring

## THE CHALLENGE OF UNDERWATER GEOLOCATION



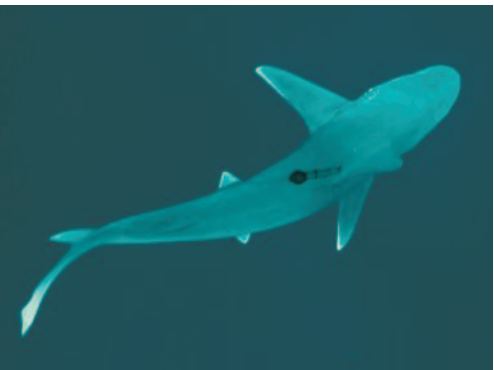
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### Light-based-only geolocation

Most archival tags rely on light measurements to perform underwater positioning. Tag manufacturers classically provide the software or the service to perform such a light-based-only geolocation of their tags. However, this positioning technique is far less accurate than satellite positioning, yielding errors ranging from 1 to 5 degrees in latitude, or even worse at the equinoxes or in turbid waters.

### Improved geolocation

In the last few years, CLS scientists actively contributed to the development of new techniques to improve light-based-only geolocations. These new techniques combine various technical enhancements:

- Light-data are significantly improved by identification and reduction of systematic errors, and sequential filtering
- Animal movement models are used to constrain position estimates
- Positions are further adjusted to match satellite-derived sea-surface temperatures with the near-surface water temperature measured by the tag
- Diving depths are used to constrain the animal position in shallow waters.

### A service for challenging data

Implementation of these new improved geolocation techniques proves to be challenging as it requires joined processing of tag measurements and large satellite oceanography data sets. This is the kind of challenge for which CLS is specially well geared!

Based on the expertise of its Satellite Oceanography Division combined with its unique experience in ARGOS and tag data processing, CLS has decided to provide an enhanced underwater geolocation service to all teams using pop-up and internal tags.

This service is dedicated to fisheries scientists and marine biologists who prefer to **focus on the ecological interpretation of tag results** rather than on the technicalities of tag data processing

## OUR SERVICE

Suited for most types of internal or pop-up archival tags, our new tag data processing service includes:

### ■ DIRECT DATA RETRIEVAL FROM ARGOS

Pop-up tag data can be directly retrieved from ARGOS as part of the Track & Loc service

### ■ OPTIMAL ESTIMATION OF THE ANIMAL'S PATH

Positioning errors are reduced by improved processing of light data, position filtering using an animal movement model and optimal use of positioning constraints provided by sea surface temperature measurements and bathymetry

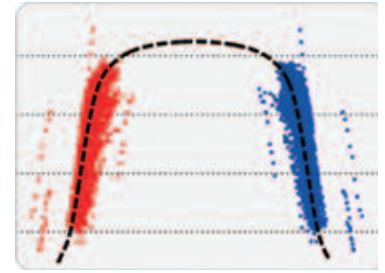
### ■ DELIVERY OF RAW & PROCESSED DATA

Track & Loc users receive raw and processed data in standard, fully-documented formats. Estimated trajectories are provided as time series of daily positions with estimated errors in latitude and longitude

### ■ DATA ARCHIVAL

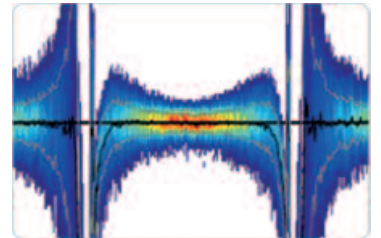
The tag data and related processing information are archived at CLS. Then, as geolocation algorithms evolve, reprocessing of ancient data can be achieved at minimum cost to improve data quality and homogenize data sets

## FILTERING

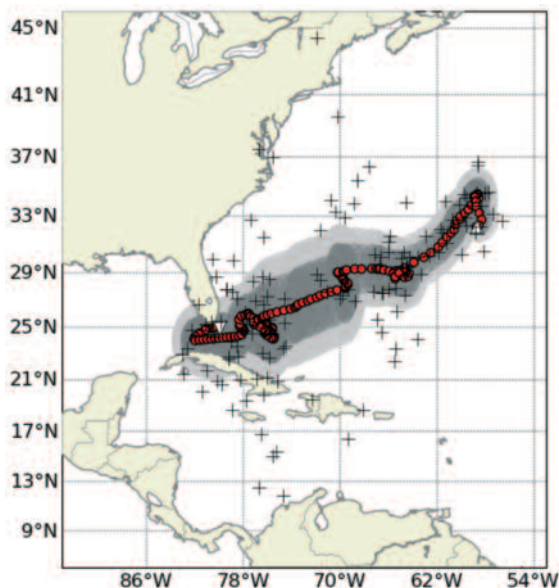


Robust sequential filtering of light levels or sunrise/sunset.

## REDUCING SYSTEMATIC ERRORS



Identification and reduction of systematic errors in light measurements, largely improving positioning accuracy near the equinoxes.

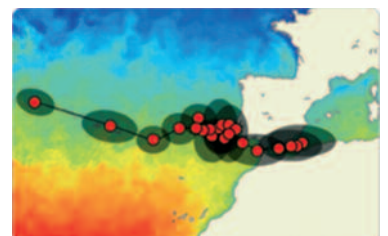


## A TYPICAL TAG DATA PROCESSING RESULT

This trajectory is estimated by combining a movement model, light data, temperature measurements and bathymetry constraints.

The resulting trajectory (in red) minimizes location errors. It is a major improvement of the original light-based geolocations (crosses).

## USING TEMPERATURE AND BATHYMETRY



Sea-surface temperature and bathymetry constraints are combined with an animal movement model to further reduce positioning errors (estimated positions in red and error ellipses in black).



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## Technical references

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# CLS, combining 30 years of Argos experience with oceanographic expertise

## Why choose CLS

- Expertise:** Over the last five years, CLS has developed significant underwater geolocation expertise. This expertise largely relies on the skills and products of the CLS Satellite Oceanography Division. Our processing algorithms are published in the open peer-reviewed literature (see our technical references above).
- Experience:** As of today, our Track & Loc service has been used to successfully process several hundred of tags (both pop-up and internal tags) deployed on various marine species. And CLS, the official operator of the Argos system, has 30 years of experience in animal tracking!
- Data processing services:** Specializing in in-situ and space-based observations, CLS has a unique experience in environmental data processing. CLS is in charge of Argos data processing since its creation in 1986. Since 1992, CLS also processes, for the oceanographic community, the data from most satellite altimetry missions.

[www.argos-system.org](http://www.argos-system.org)



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