Assessing the effect of sea turtle diving behaviour and environmental drivers on the accuracy of satellite telemetry locations using Fastloc GPS data

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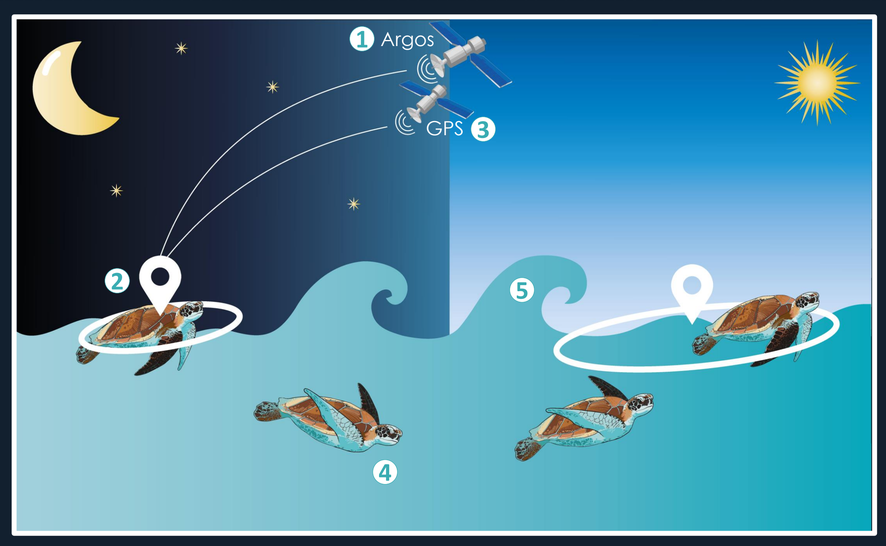


ASSESS LOCATION ACCURACY TO BETTER UNDERSTAND ITS INFLUENCING FACTORS AND ALGORITHMS PERFORMANCE

Argos Satellite telemetry ❶ is widespread used to describe free ranging animal movements. However, animal behaviour, technological barriers and environmental variations can cause uncertainties on location estimates. In this work, we assess the potential impact of multiple factors into location error estimates ❷ using Fastloc GPS data ❸. Specifically, we focus on the effect of sea turtle diving behaviour ❹ and oceanographic drivers ❺.

MATERIAL AND METHODS

TAGGING

- Juvenile loggerheads (n=3)
- Capture by hand at Balearic sea
- CCL 46 cm – 83 cm
- Argos-TTDR-Fastloc (SPLASH tags, Wildlife Computers)

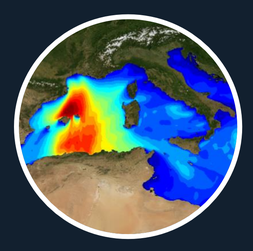
LOCATION ERROR

- Argos: speed & angle filters
- Fastloc: satellites nb & residuals
- Argos-Fastloc match within 15min
- Compute location error comparing Argos and Fastloc GPS (true location)

DIVING ANALYSIS

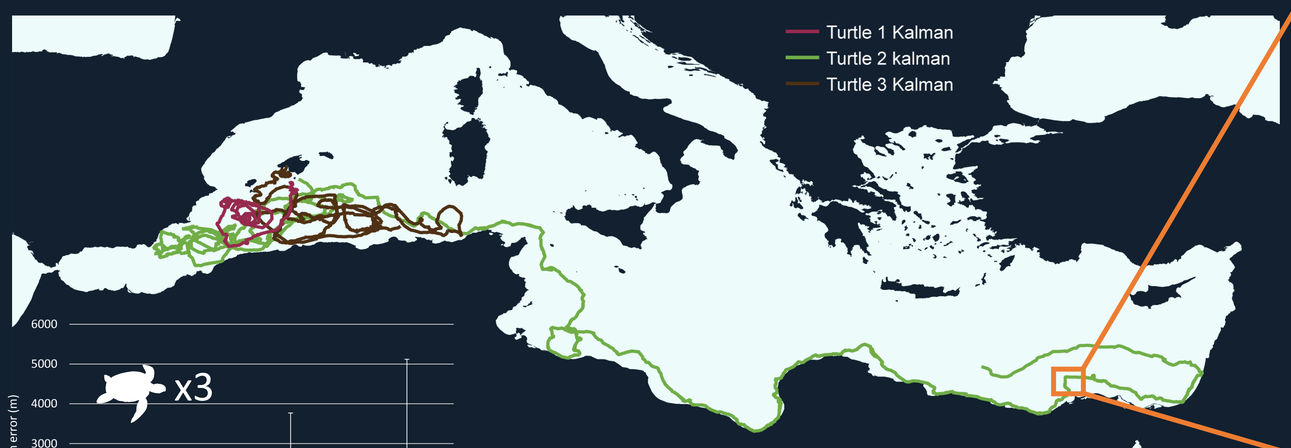
- Depth data every 5 min
- Sensor drift correction
- % time at surface (<3m)

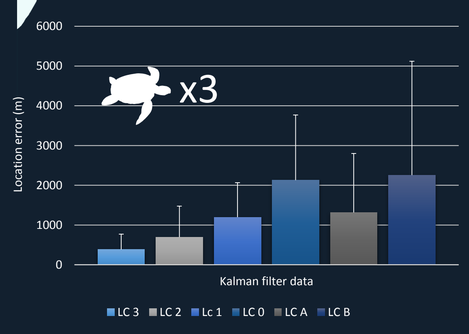
OCEANOGRAPHIC DRIVERS



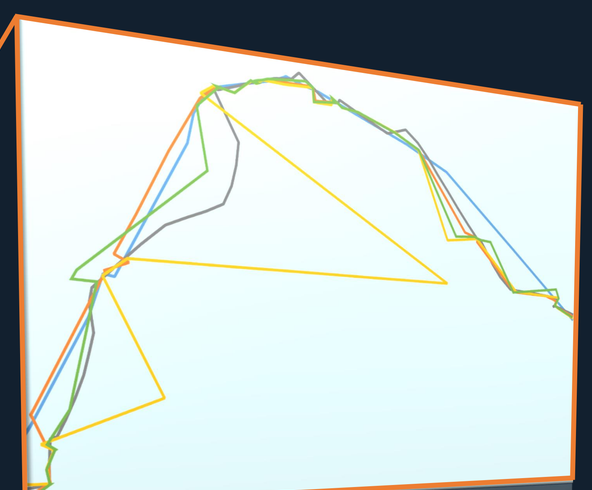
- Extract wave data from CMEMS
- Interpolate hourly data to Argos-Fastloc matches

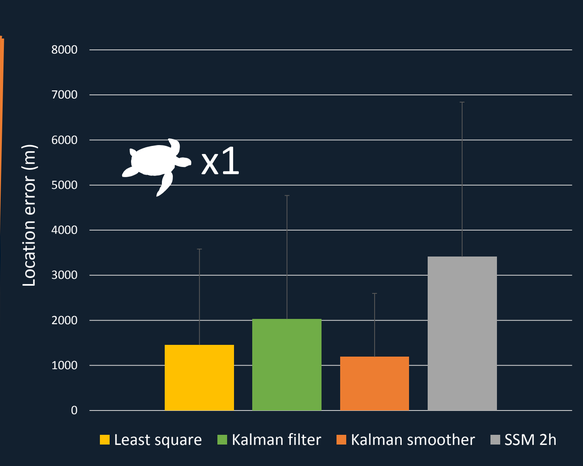
ASSESSING LOCATION ERROR USING FASTLOC GPS





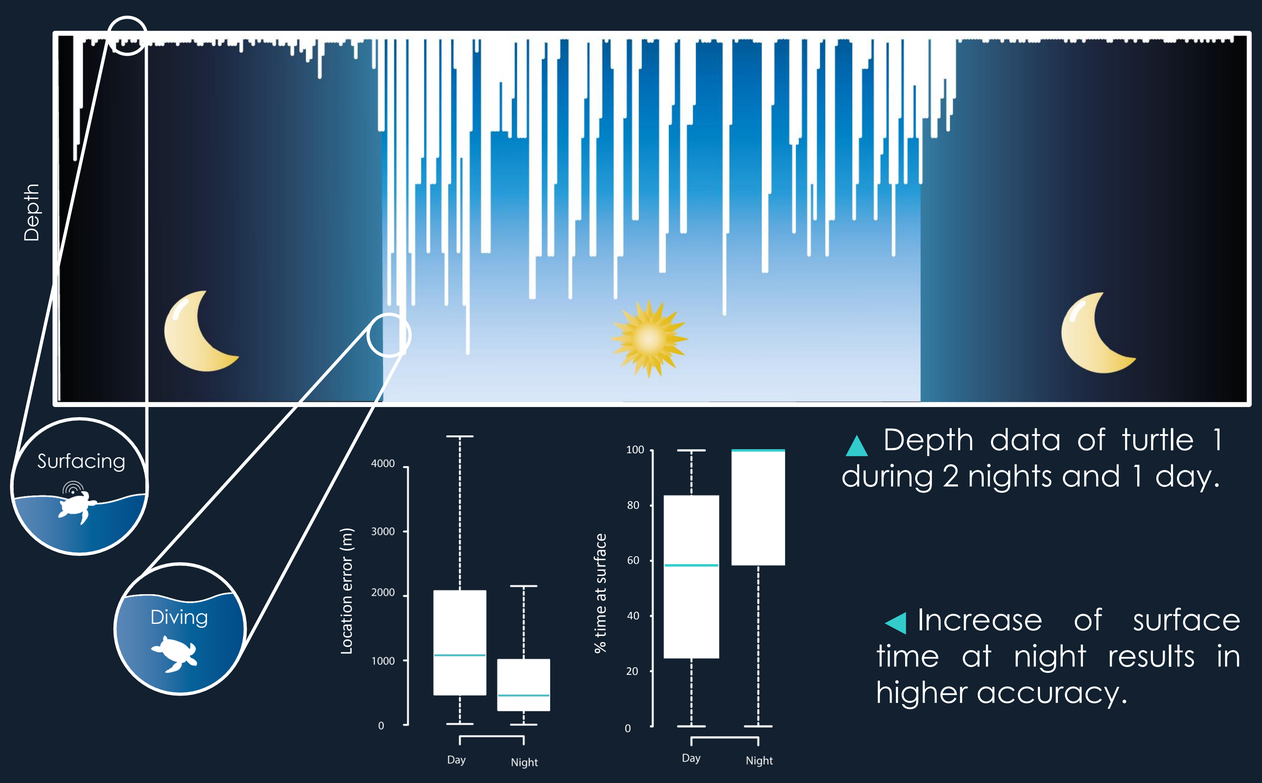
◄▲ Tracks and average error by LC of the 3 turtles data. Data are post-processed using Kalman Filter. Speed and angle filters are also applied to discard obvious erroneous locations.





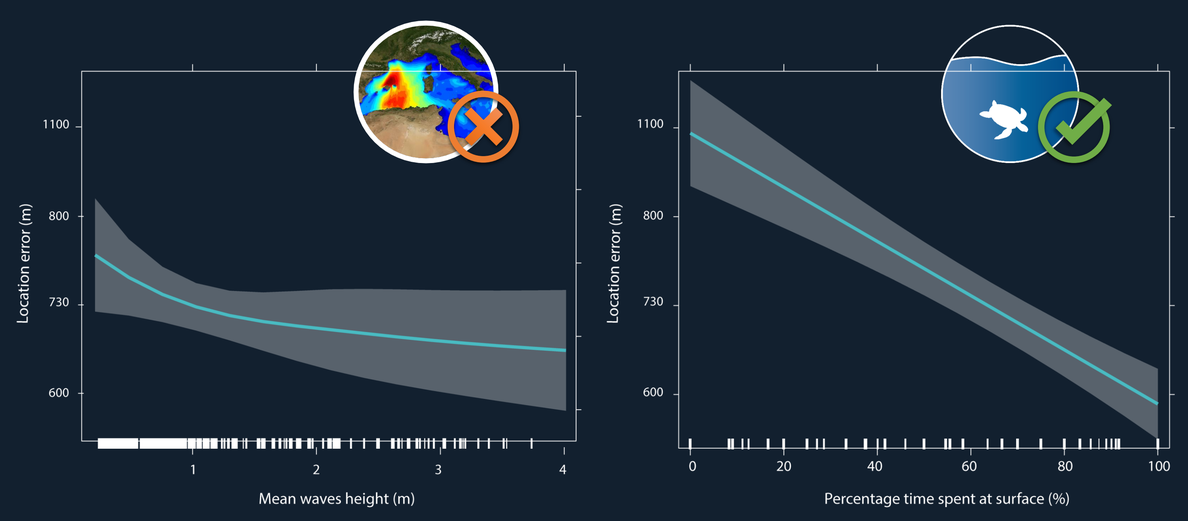
▲ Location error for turtle 3 using different algorithms. Kalman smoother provides the most accurate positions.

EFFECTS OF DIVING BEHAVIOUR AND WAVES ON LOCATION ERROR



▲ Depth data of turtle 1 during 2 nights and 1 day.

◄ Increase of surface time at night results in higher accuracy.



▲ Partials effects of waves (left) and time spent at surface (right) resulting from GLMM analysis for the following model:
Log(Distance error) ~ Percentage at surface + log(waves) + turtle (random).

CONCLUSION

Our findings provide evidence that intra-individual variability, should be taken into account when considering location errors. In overall, our work shows that integrating both environmental drivers and diving behaviour can provide a better understanding of location error in satellite tracking studies.

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