

Performance expectations (Argos & GPS)



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Presented data based on: Witt et al. (In Press) **Assessing accuracy and utility of satellite tracking data using Argos-linked Fastloc-GPS.** *Animal Behaviour*

Argos geolocation

- To create an Argos-derived location, multiple messages from a transmitting tag must be ‘heard’ by a receiver on an over-passing satellite
- Knowledge on the strength of the signals (messages) received can then be used to derive a position on the earth
- Resulting Argos locations are associated to spatial error classes that indicate how accurate the location should be considered



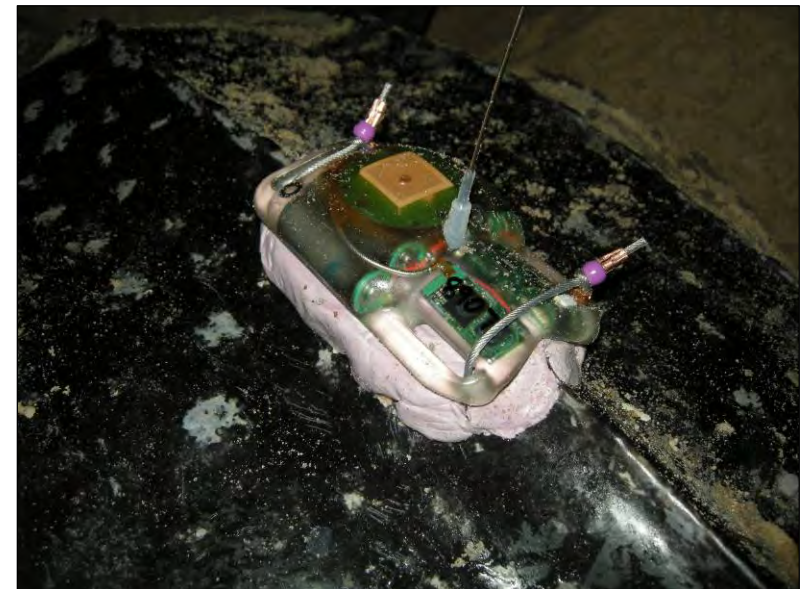
GPS geolocation

- Earth based receivers listen for signals transmitted by special global positioning system (GPS) satellites
- Information from received GPS signals can then used to determine location
- Two datasets are needed by GPS receivers (Almanac & Ephemeris) to calculate instantaneous position, these data are contained within the GPS signals
- locations are very accurate (< 20 m accuracy)



GPS on animal tags

- Tags for land animals typically use normal GPS, but you need to get the tag back to download the collected data
- Some tags have Argos integrated to transmit the collected GPS data
- Tags for animals at sea use either NavSys (TrackTag) or Fastloc (Wildtrack Solutions) fast GPS solving approaches
- These tags collect all 'heard' signals from the GPS satellite constellation for later post-processing into locations (transmitted through Argos)
- Locations from TrackTag and Fastloc are of good spatial accuracy (but slightly less than standard GPS)



All data need filtering

- Argos and Fastloc/NavSys GPS data require at least some filtering to remove locations with poor accuracy or plausibility
- Filtering approaches (for both Argos & Fastloc):
 - By location class (Argos)
 - By residual error (Fastloc)
 - By speed
 - By distance
 - By azimuth (angle)
 - By elevation/bathymetry



What can you expect from Argos & Fastloc GPS data?

- Factors affecting transmission durations:
 - battery configuration
 - device type
 - attachment method
 - species
 - habitat occupied
- Behaviour strongly influences:
 - number of locations
 - positional accuracy
- *** For turtles you will frequently you get a high proportion of low accuracy Argos locations ***

Assessing Argos accuracy using Fastloc

- Argos provides an excellent way to follow movements of animals, but the method has some problems
i.e. high prop of low accuracy positions
- We have used near temporally instantaneous Fastloc locations from Argos-Fastloc tags to see how reliable the Argos geolocation method is...
- Argos is here to stay (Fastloc still too expensive) so best to get a really good understanding of the issues with Argos and caveat findings as appropriate

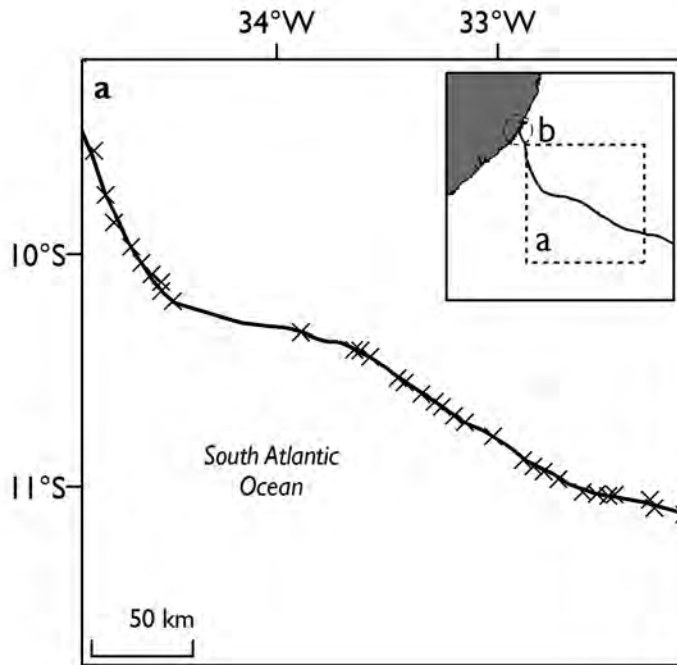
Sirtrack Fastloc tag on juvenile green turtle



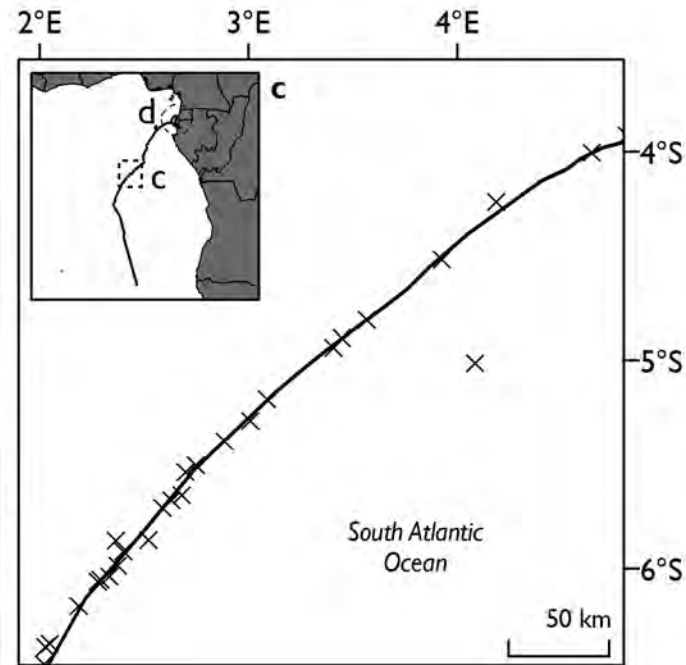
Wildlife Computers MK10-AF on adult female leatherback turtle



Migratory movements



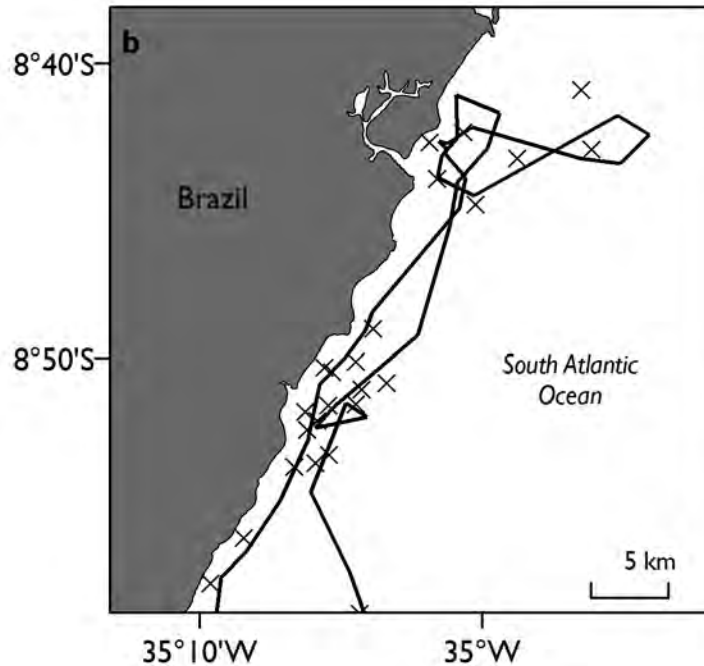
Sirtrack Fastloc on adult female green turtle migrating to Brazil from Ascension Island (South Atlantic)



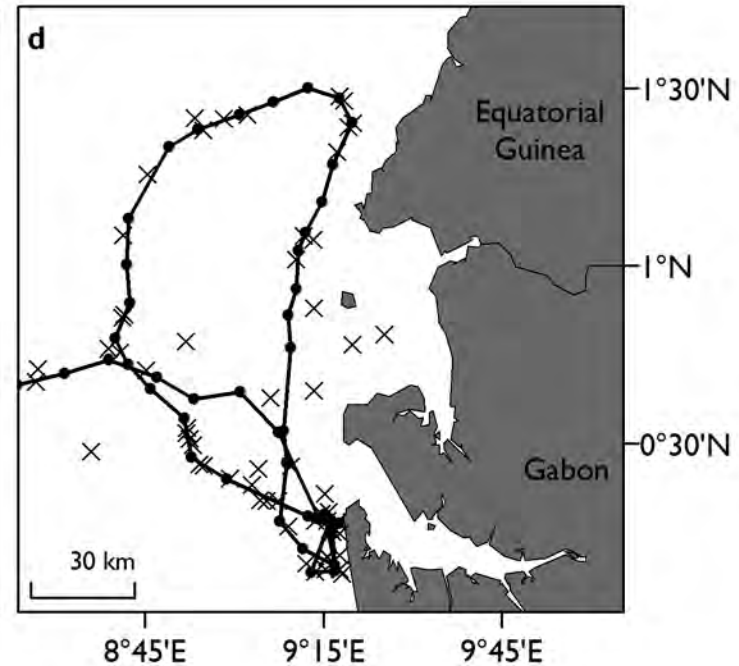
Wildlife Computers MK10-AF on adult female leatherback turtle migrating from Gabon to Central South Atlantic

Black line is movement derived from Fastloc,
crosses are Argos-derived locations

Coastal movements



Sirtrack Fastloc on adult female green turtle in Brazil



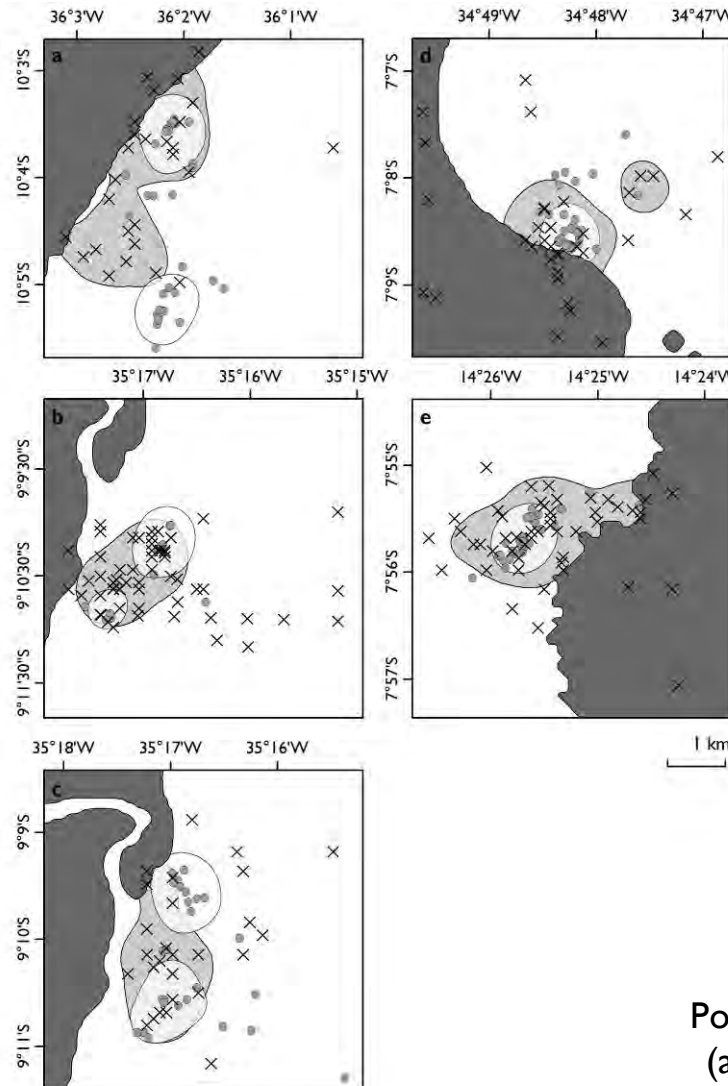
Wildlife Computers MK10-AF on adult female leatherback turtle in Gabon

Black line is movement derived from Fastloc,
crosses are Argos-derived locations

Home range assessment

Argos locations
(crosses), home-range
estimate from these
locations
(dark grey polygons)

Fastloc locations
(filled circles), home-range
estimate from these
location
(light grey polygons)



a-d) Sirtrack Fastloc tags
on adult female green
turtles in Brazil

e) Sirtrack Fastloc
tag on adult female
interesting green
turtle

Polygons are home range estimates
(a 2-d smoothed estimate of area
used based on received locations)

Our efforts to estimate Argos location accuracy

Location class	N comparisons	CLS estimates * (metres)	Our estimate (metres)
3	54	< 250	400 ± 200
2	81	250 - 500	700 ± 700
1	133	500 - 1500	800 ± 700
0	108	> 1500	2300 ± 2700
A	398	No accuracy	1400 ± 2500
B	546	No accuracy	1800 ± 3900

*Argos CLS Manual 14th October 2008

Based on green (n = 5) and leatherback (n = 4) turtles undertaking internesting, migration and foraging movements in the South Atlantic Ocean.

Summary

- Argos is good for migration studies
- In areas where animals demonstrate site residency Argos tends to inflate estimate of area use
- Theoretically, you can receive more locations from Fastloc tags, but this carries additional data cost and greater power demands leading to shorter tag lifetimes
- Remember, behaviour enforces duty cycling on both Argos and Fastloc data
- Use small samples of Fastloc tags integrated with larger number of Argos-only tags to increase overall sample size at a study site