

# Fast-GPS Technology (Fastloc)

## Successful field results tracking the fine-scale movements of pinnipeds at sea using Wildlife Computers Mk10-AF tags



### Introduction:

Traditional GPS receivers are rarely successful when deployed on free-ranging marine animals which spend very little time at the surface. The short surface interval precludes the time-consuming acquisition of the satellite almanac and ephemeris data necessary for GPS positioning. To address this issue, Wildtrack Telemetry Systems developed a novel approach (Fastloc) which bypasses the need to acquire the almanac and ephemeris data and only requires a very quick snapshot of the GPS constellation signals. This snapshot can be completed in .008 seconds. The ability to achieve highly-accurate GPS locations, while only requiring the antenna to be above the surface for less than one second, represents a revolution in the ability to track marine animals.

Wildlife Computers incorporated this Fast-GPS technology into their Argos-linked data recording tag. This tag (Mk10-AF) acquires the GPS signal snapshots and archives them along with depth and temperature data. A percentage of the summarized data and Fast-GPS snapshots are transmitted via the Argos system. Recovery of the Mk10-AF tag yields the full archive of all Fast-GPS snapshots and sampled data.

Field trials were undertaken in November 2005 to establish the actual performance of Fast-GPS technology on free-ranging marine animals in their native environment.

### Methods:

Northern elephant seals and nursing female California sea lions were selected for this trial based upon animal accessibility and behavior.

Elephant seals provide one of the toughest challenges for radio-telemetry, as they spend very little time at the surface. Two juvenile seals were captured at the Año Nuevo haul-out site (north of Santa Cruz, California), tagged and moved by truck to the Monterey Bay peninsula. Upon release, these "translocated" seals were expected to return to their original haul-out site where they could be recaptured and the Mk10-AF tags recovered. This study was expected to provide three to four days of data.

Five nursing female California sea lions were captured and tagged, two at San Nicholas, and three at San Miguel. These females are expected to make repeated foraging trips, returning to nurse their pups. The tags will be recovered in January.

All the Mk10-AF tags were programmed to attempt a GPS snapshot every fifteen minutes.



### Results:

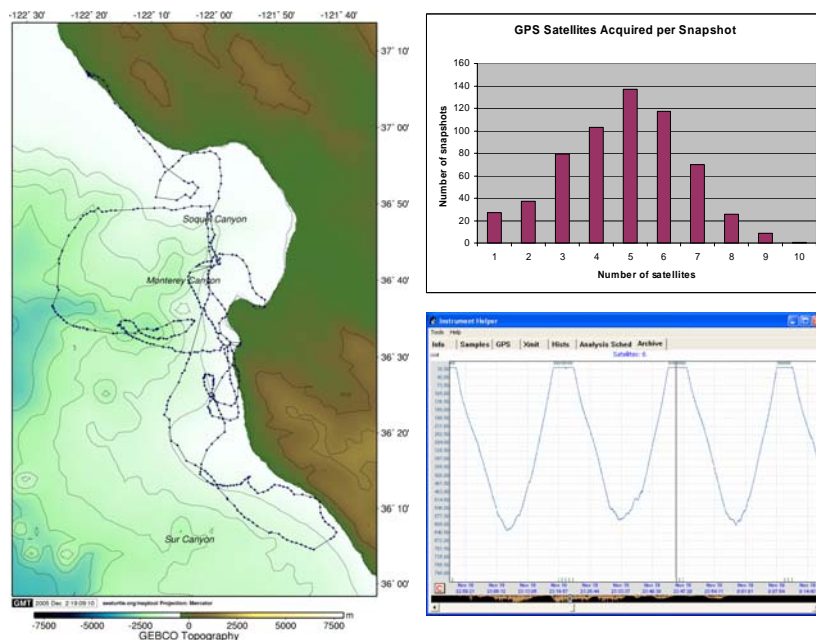
#### Elephant seal track from recovered archival data

Both elephant seals were recaptured and data from the tags' archive recovered. Below is the data from tag 05A0367. This animal was at liberty for 9 days. During this time, 641 GPS snapshots were possible, based on taking a snapshot every surfacing, but no more frequently than every 15 minutes.

A total of 607 snapshots were acquired over the deployment. The histogram below shows the distribution of the number of satellites acquired for each snapshot.

463 locations were calculated. The map below shows the seal's track as it wandered from the release point at the Monterey Bay peninsula to the recovery point. Current Fast-GPS algorithms require acquisition of 4 satellites in order to calculate a location. Enhancements to the algorithm are in work which would allow location calculations using only 3 satellites, which will increase the number of locations to 542.

The line graph below shows the diving behavior of the seal. This animal exhibited typical dive depths of >600m, dive durations of 15-20 minutes, and surfacing intervals of 3 minutes or less. The Mk10-AF was often able to acquire a GPS snapshot and make at least one Argos transmission at each surfacing interval. This means a high-resolution location is available at each inter-dive interval, allowing the calculation of horizontal as well as vertical displacement during each dive.

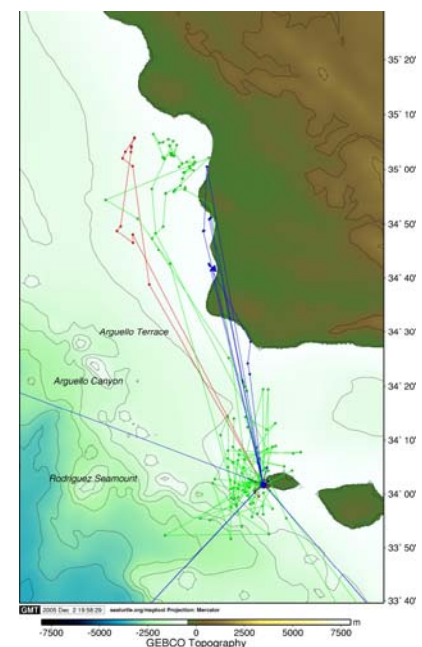


#### Sea lion tracks from Argos data

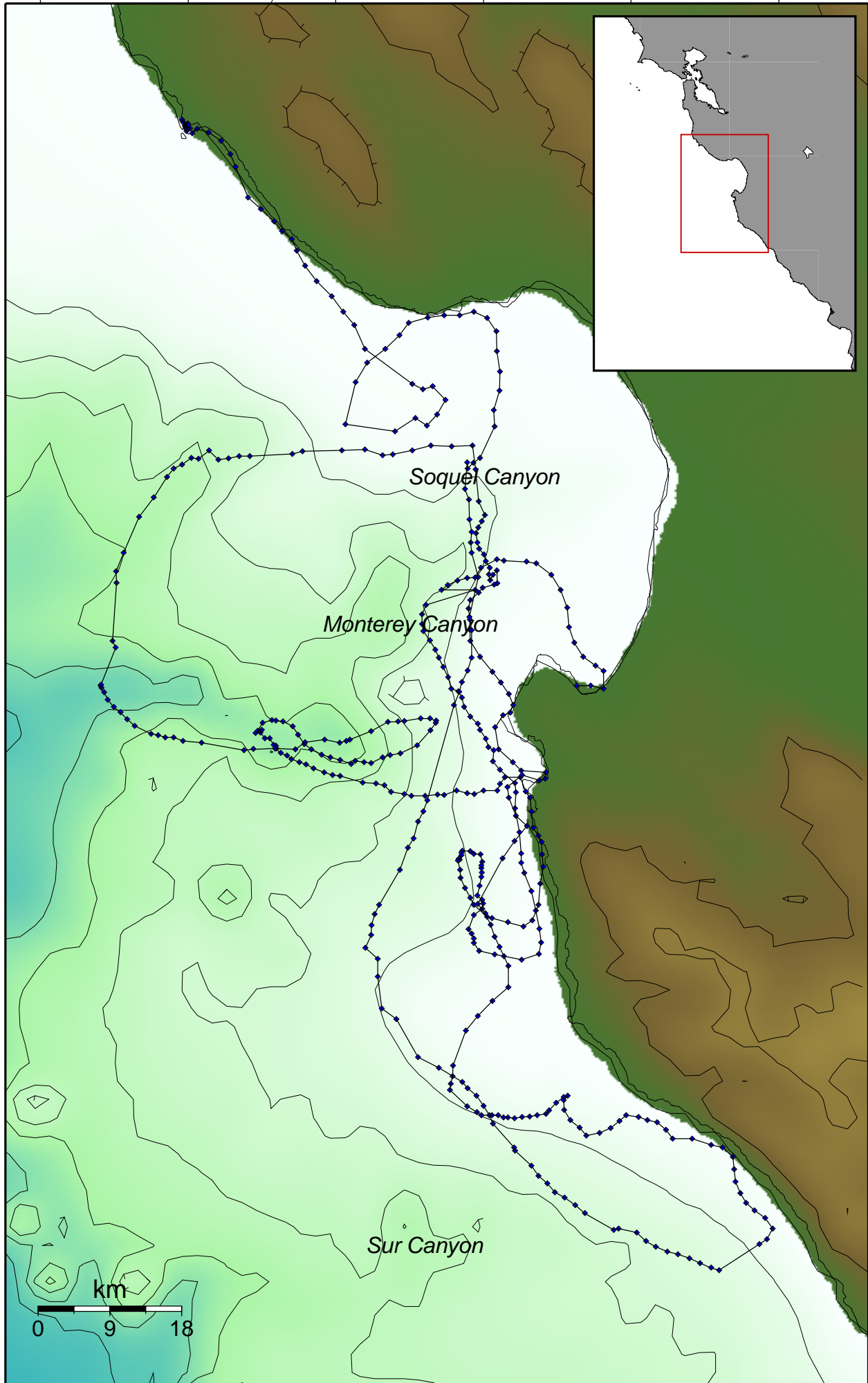
The sea lions are still at liberty. We are receiving approximately 20 GPS snapshots per day through the Argos system. It should be noted, however, that this number is skewed because the animals are alternating foraging trips with 2-3 day haul-outs to feed their pups.

The map below shows the Fast-GPS locations calculated from the GPS snapshots received through the Argos system for the 3 sea lions tagged on San Miguel Island. This map contains approximately two weeks of data.

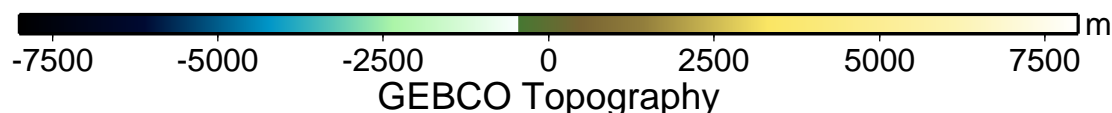
We look forward to analyzing the full archive in January when the animals are recaptured.



-122° 30'    -122° 20'    -122° 10'    -122° 00'    -121° 50'    -121° 40'



GMT 2005 Dec 9 15:10:56 seaturtle.org/maptool Projection: Mercator



GEBCO Topography