Suggested citation:

Data package files:

File name*	File contents	File format
.\rawData files:		
<NAME>_deploymentAttributes.csv	Deployment data	UTF-8 (ASCII), CSV
<NAME>_diagLegacy.txt	Argos DIAG, legacy format	UTF-8 (ASCII), custom
<NAME>_diagTabular.csv	Argos DIAG, tabular format	UTF-8 (ASCII), CSV
<NAME>_dsLegacy.txt	Argos DS, legacy format	UTF-8 (ASCII), custom
<NAME>_dsTabular.csv	Argos DS, tabular format	UTF-8 (ASCII), CSV
<NAME>_rawData_metadata.xml	Metadata	UTF-8 (ASCII), XML
.\processedData files:		
<NAME>_decodedSensorBehavior.csv	Decoded sensor data	UTF-8 (ASCII), CSV
<NAME>_deploymentAttributes.csv	Deployment data	UTF-8 (ASCII), CSV
<NAME>_diag_filteredLocations.csv	Argos DIAG tab, w/ filter flag	UTF-8 (ASCII), CSV
<NAME>_GPS_filteredLocations.csv	GPS, w/ filter flag	UTF-8 (ASCII), CSV
<NAME>_processedData_metadata.xml	Metadata	UTF-8 (ASCII), XML

 *<NAME>: pacificWalrus_USGS_ASC_argosGPS

Deployment data description (included with all data packages):

- ### Deployment Attributes file:

  Copies of this data file appear in both the .\rawData and .\processedData subdirectories. It contains information that documents which transmitters were deployed on which individual animals, the deployment dates, and ancillary attributes about the animals if recorded (e.g., sex, age, weight, etc.).

  This file contains a categorical variable named *Deployment_Fate* with five possible values: alive, dead, shed, shed/dead, and undetermined. The value of *Deployment_Fate* was determined by a manual assessment of sensor and movement data with the goal of defining the date/time when tracking each live free-ranging animal may have ended. That date/time is recorded in the variable *Deployment_End_Timestamp_UTC*.

Deployment_Fate		Deployment_End_Timestamp_UTC
alive	Default – No evidence that animal died or shed PTT	Time stamp of the last transmission obtained from the PTT or shortly thereafter
shed	Definitive – a live animal observed without attached PTT	Time stamp of the last transmission obtained from the PTT with sensor data indicating attachment to a live free-ranging animal. In a few cases a series of relocations obtained at the end of a deployment indicated that the tag was still attached to a free-ranging walrus although no behavior records were obtained through the Argos relayed sensor data stream. In those cases, deployment was set to the time stamp of the last plausible location.
dead	Definitive – observed carcass or unambiguous sensor data	
shed/dead	Ambiguous – evidence of shed or dead, but insufficient evidence to distinguish which one	
undetermined	No assessment of mortality or attachment	No time stamp is provided

All tabular-format data files in this data package (described below) include a related, *Tracking_Status,* variable. *Tracking_Status* = 'alive' for all data records collected while the animal was believed to be alive. If there was evidence that the animal died, or the transmitter was shed, then all data records thereafter will have *Tracking_Status* coded as dead, shed, or shed/dead. ***Users are cautioned to exclude post-mortality or post-detachment data records before analyzing data assumed to be collected from live, free-ranging animals.***

Note that the final tracking destination (location) of an animal may have only been obtained post-mortality or post-detachment. Raw Argos data are included for up to several months beyond that date to ensure information from after the *Deployment_End_Timestamp_UTC* was preserved (if available). If final destinations are of interest, the first 'non-alive' locations (if available) should be examined. To help prevent unintended use of 'non-alive' location data, the coordinates of those records in the "diag_filteredLocations" and "GPS_filteredLocations" files (in the processed data folder) are stored as the variables *Lat_ShedDead* and *Lon_ShedDead*.

Raw data-package file descriptions

- <u>Argos DS (a.k.a. Dispose) legacy format file</u>:

    The Argos DS format contains all transmissions (messages) collected during any given satellite overpass. Each overpass is reported on multiple lines of data beginning with a header (PTT id, satellite ID, etc.) and followed by a variable number of records reporting the raw sensor data conveyed by each transmission. DS is the most appropriate data format for decoding sensor data for subsequent analysis. The DS legacy data have been archived in their original format as received from CLS (a.k.a. Service Argos). That format, however, has changed a few times since its inception in the early 1980s. Description of the Argos DS legacy format is provided in Argos System User Manuals.

- <u>Argos DIAG (a.k.a. Diagnostic) legacy format file</u>:

    The Argos DIAG format (since 1988) contains multiple lines of data for a given satellite overpass that report the primary location estimate, the alternate location estimate, and several other

variables such as the location class index (accuracy) and signal strength and concludes with raw sensor data values obtained from a single transmission that was arbitrarily selected from all transmission received during the overpass. DIAG is the most appropriate data format for extraction of location data for subsequent analysis. The DIAG legacy data are in their original format as received from CLS (a.k.a. Service Argos), but that format has changed a few times since its inception in the late 1980s. Description of the Argos DIAG legacy format is provided in Argos System User Manuals.

- Argos DS tabular format file:

  The DS tabular data format contains the same information as the legacy DS format, however, all the variable values from each message are reported on a single comma-delimited record. As such, the tabular DS format is more convenient for ingestion by software that works with tabular records. Tabular DS holds a full complement of the raw sensor data in which one data record contains the data obtained from one PTT transmission. Ancillary identifying variables and *Tracking_Status* have been added to the tabular records by USGS for this data release.

- Argos DIAG tabular format file:

  The DIAG tabular data format contains the same information as the legacy DIAG format, however, all the variables associated with a given satellite overpass are reported on one single comma-delimited record. As such, the DIAG tabular format is more convenient for ingestion into software that work with tabular records. Tabular DIAG holds a full complement of raw <u>unfiltered</u> location data. One data record contains all variables (including primary and alternate location estimates) from one satellite overpass. Ancillary identifying variables and *Tracking_Status* have been added to the tabular records by USGS for this data release. Prior to July 2009, the variable *Pass_Satellite_ID* was added to the DIAG tabular records by USGS through temporal matching with the satellite overpasses in the DS data; please note that since multiple satellites can be visible to the transmitter at the same time, it is possible that some satellite IDs may be mismatched (prior to July 2009 only). Also, beginning July 2009, the tabular DIAG files contain data fields describing the Argos error ellipse.

Processed data-package file descriptions

- Filtered Argos DIAG data - tabular format:

  This data file contains every record from the raw DIAG tabular format that had an Argos location estimate. A variable named "*DAF_Filter*" has been added by USGS that flags implausible locations: *DAF_Filter*= 1 for implausible locations and *DAF_Filter*=0 for plausible locations. Implausible locations were identified using the [Douglas Argos-filter Algorithm](#) as implemented at the Movebank tracking data portal (www.movebank.org) as follows:

  The Argos DIAG tabular data and telemetry attributes files were uploaded into a Movebank Study named "pacificWalrus_USGS_ASC_argosGPS". The Douglas Argos-filter (DAF) was then applied using the user-defined parameters shown below:

Argos DD Filter ⓘ

Filter Method	DAR ▾	Best Hybrid filter parameters:	
keep_lc	1 ▾	xmigrate	2
maxredun	2	xoverrun	1.5
		xdirect	20
Duplicate record treatment:		xangle	150
offset by one sec.	◉	xpercent	20
filter	○	testp_0a	2
		testp_bz	3
MRD filter advanced parameters:			
keeplast	☐ enabled	Best of Day filter	☐ enabled
skiploc	☐ enabled	pickday	☐ enabled
		minoffh	8
DAR filter parameters:		rankmeth	1 (LC, IQX, IQY, NBMES) ▾
minrate	10		
r_only	☐ enabled		
ratecoef	25		

As recommended by Douglas et al. (2012), DAF decisions for each animal's track were manually scanned and over-ridden when deemed appropriate. The final binary filtering flags were downloaded from Movebank and added to the DIAG tabular file (the *DAF_Filter* variable as described above). The processed DIAG tabular file also adds the *Latitude* and *Longitude* variables that contain an algorithm-derived choice between the two location solutions (*Location_Lat/Long_Solution_1* vs. *Solution_2*) which are products of Doppler-based geolocation methods. *Latitude* and *Longitude* are empty when *Tracking_Status* does not equal 'alive'. Coordinates for any locations obtained after *Deployment_End_Timestamp_UTC* are stored as *Lat_ShedDead* and *Lon_ShedDead* to minimize risk of unintended analysis.

- GPS data:

This data file contains every recorded GPS location.

- Decoded sensor data file:

The transmitters summarized in this data package collected sensor data used to interpret the tracked walrus' haulout and foraging status during regular length intervals. Raw sensor data were transmitted as binary encoded behavior classes. USGS interpreted these binary encoded messages along with the timestamp of the transmission reception to reconstruct the behavioral chronology of the tracked walrus. Because parity errors can corrupt the received binary messages, USGS employed a circular redundancy check sum to identify and reject corrupted messages. USGS only reported the behavioral status of the tracked walruses if the behavior status during a chronology interval was supported by at least two messages that had passed the

cyclical redundancy check sum. Additional processing errors and chronological errors may occur within the tag's circuitry that may results in the reporting of discordant behavioral statuses during. USGS sought to guard against such errors by reporting the modal behavioral value obtained for each chronology interval. Please note that the sample size of messages informing the reported behavioral status are reported along with the number of discordant messages obtained for the haulout and foraging behavior status.

Metadata

FGDC metadata records are included with each data folder. The metadata provides specific details and definitions about all data files and variables. We encourage users to carefully examine the associated metadata to understand appropriate use and data limitations

Reading the data with Program R

Program R code designed to read the processed data-package files is provided on the USGS Alaska Science Center, Wildlife Tracking Data Collection webpage at: https://doi.org/10.5066/P9VYSWEH.

 Additionally, the same processed location data are available in the open-access Movebank Study named "pacificWalrus_USGS_ASC_argosGPS". Movebank user accounts are free (www.movebank.org). The processed location data can be downloaded from Movebank in CSV, Google Earth, or shapefile format, or, they can be read directly into Program R using the getMovebankData function from the "move" contributed package, which is available through the r CRAN network.