Standard Rate X-Tag Data and Reports

Version 1

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This document explains data and reports for Standard Rate X-Tags **only**. Other types of Pop-up Tags have separate documentation.

How to cite: Microwave Telemetry, Inc. (2016) *Standard Rate X-Tag Data and Reports*, version 1. Columbia, MD.

Part I: Understanding Data, Compressions, and Calculations

X-Tag States

The magnet functions as an on/off switch. When the magnet is placed over the white dot located on the X-Tag float (for at least 1 minute), the tag is powered OFF. Once that magnet is removed, the tag turns ON and progresses through the following sequence of states:

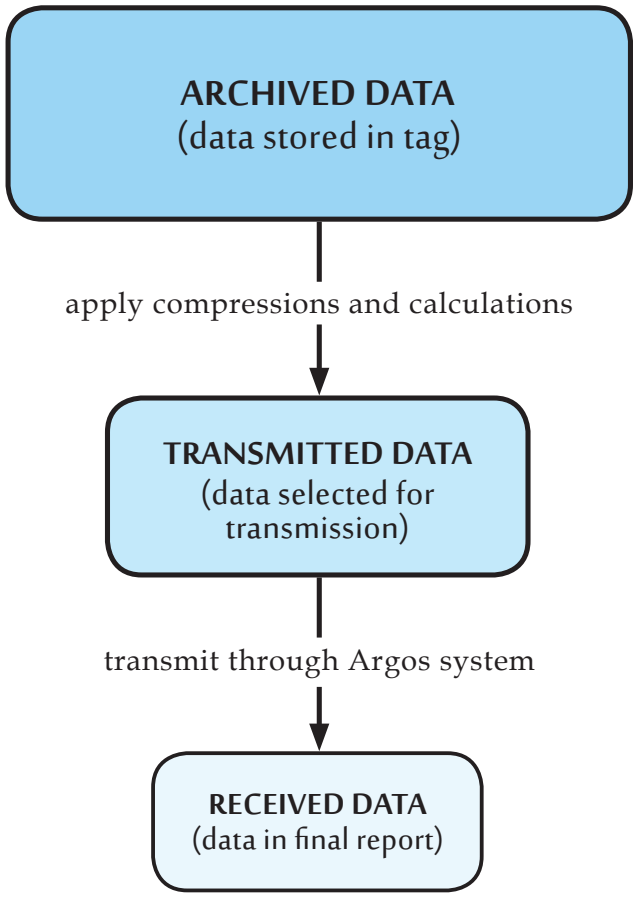
1. Constant voltage applied to release wire (1 minute)
2. Pulsing voltage applied to release wire (3 minutes)
3. Test transmissions (60 minutes)
4. Data collection
5. Pop-off release mechanism activation and data collection
6. Data transmission and data collection (until battery depleted)

The X-Tag field manual, supplied with the X-Tag order, describes the procedure for testing tags using states 1–3. This document explains data from states 4–6.

X-Tag Data

Standard Rate X-Tags collect high-resolution temperature, pressure (depth), and light measurements every two minutes while the tag is in data collection mode (states 4–6). The tag stores this entire time-series dataset, identified as the **archived** dataset, in memory. If the tag is physically recovered, the archived dataset may be extracted, providing the user with a wealth of information from the full duration of deployment. For example, a 12-month tag would provide over 750,000 combined temperature, depth, and light-level records.

Unfortunately, the entire archived dataset cannot be transmitted due to limited battery life and Argos system data throughput limitations. Given these constraints, a smaller subset of data, termed the **transmitted** dataset, is carefully selected for transmission.



Standard Rate X-Tag

This dataset is generated by a series of compressions applied to the archived dataset. Although the transmitted dataset still contains time-series depth and temperature data, the temporal and measurement resolutions are reduced (relative to the archived dataset). The temporal resolution of the transmitted dataset decreases as the deployment progresses. If the tag is deployed for a short duration (<4 months), the temporal resolution in the transmitted dataset is 15 minutes. As the deployment continues (4–8 months), the 15-minute records are overwritten with 30-minute records. Similarly, as the deployment continues past 8 months, the 30-minute records are overwritten with hourly records. Although the temporal resolution may vary throughout deployment, it is constant over the course of each day.

Deployment Duration	Transmitted Temporal Resolution*
<4 months	15 minutes
4–8 months	15–30 minutes
8–12 months	30–60 minutes

*depth and temperature records

Even if the tag transmits 100% of the transmitted dataset (which it can do in approximately 10 days), all the data may not be received by the Argos system. The dataset that is successfully collected by the Argos system and presented in the data report is referred to as the **received** dataset. Unless the tag is physically recovered, the only data available to the user is the received dataset.

The received dataset also includes **real-time** measurements. When a tag is in transmission mode (state 6), it will periodically transmit real-time data messages, providing a snapshot of the tag in its current condition. Real-time measurements include information such as instantaneous battery level, temperature, depth, and light level. Additionally, the tag transmits the pop-off reason and pop-off date and time.

The Standard Rate X-Tag is designed to transmit the following information:

- Time-series temperature and depth records
- Daily minimum and maximum temperature, depth, and light-level records
- Daily sunrise and sunset times with corresponding approximate depth records*
- Daily light-based latitude and longitude estimates*
- Real-time data and Argos locations from transmission period
- Pop-off reason and pop-off date and time

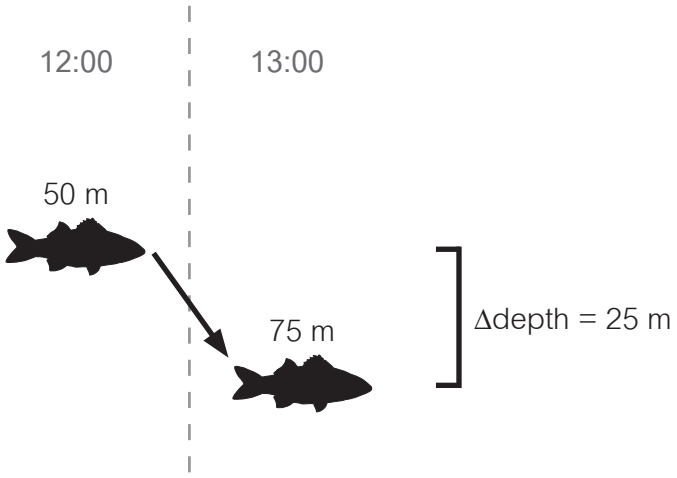
* Tag must have access to daily varying solar light levels in order to estimate sunrise/sunset times and corresponding geolocations.

Delta Limited Values

The archived dataset contains a vast amount of information. Consequently, the archived data are carefully compressed and packaged into a format that can be successfully transmitted to Argos in the time frame permitted by the battery. Any method of compression is going to result in the loss of information, but our engineers have designed a compression technique that offers an optimal trade-off between measurement resolution, quantity of data records received, temporal distribution of records, and measurement accuracy. However, the compression techniques lead to the possibility of "**delta limited**" depth and temperature values in the received datasets. These records may not capture the full extent of the depth or temperature time-series profile.

This section begins with the explanation of delta limited depth values. Delta limited temperature values are very similar and are described at the end of this section.

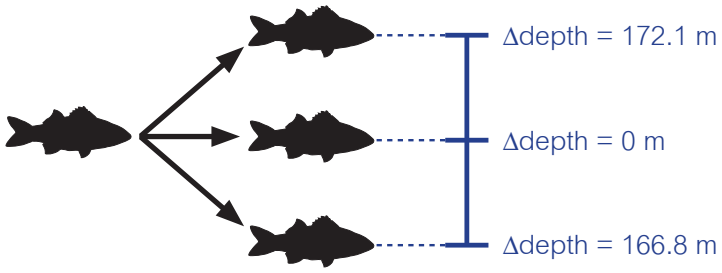
Our method of time-series compression focuses on how depth measurements change between consecutive hours. For example, suppose at 12:00 the tag measures a depth of 50 m, and one hour later at 13:00, the tag measures a depth of 75 m. The change in depth for this hour (termed "delta value") is 25 m.



Periodically through the day, full-resolution depths are designated as a reference for the subsequent delta depth values. Consider the following transmitted depth data example. The depth measurements during the hour of 12:00 (12:00, 12:15, 12:30, and 12:45) are designated as accurate reference measurements. The delta values are not necessarily calculated with respect to the previous depth record, but rather delta values are calculated with respect to the measurement 60 minutes earlier.

Time	Delta (Δ)	Depth (m)	
12:00	x	50	Reference measurement
12:15	x	45	Reference measurement
12:30	x	36	Reference measurement
12:45	x	52	Reference measurement
13:00	+ 5	55	Change in depth relative to 12:00
13:15	- 2	43	Change in depth relative to 12:15
13:30	+ 12	48	Change in depth relative to 12:30
13:45	+ 3	55	Change in depth relative to 12:45
14:00	+ 2	57	Change in depth relative to 13:00
14:15	+ 2	45	Change in depth relative to 13:15
14:30	+ 10	58	Change in depth relative to 13:30
14:45	- 3	52	Change in depth relative to 13:45

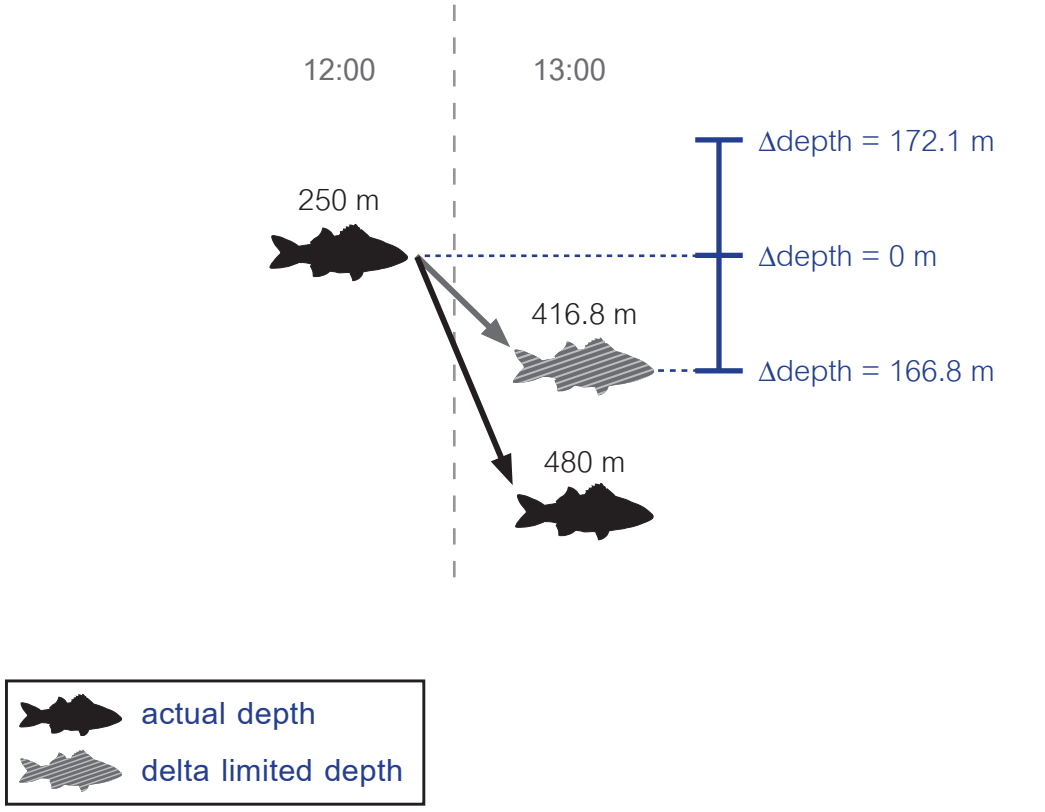
There is a limit to the change in depth (delta) that can be accurately represented in the **transmitted** dataset. If a fish descends more than 166.8 m or ascends more than 172.1 m in a one-hour period, the actual descent or ascent cannot be accurately represented and the depth record is identified as **delta *limited*** in the transmitted dataset.



Delta Limited Descent

Example 1

Suppose at 12:00 an X-Tag measures a depth of 250 m, and one hour later at 13:00, the tag measures a depth of 480 m. This is a depth difference of 230 m, but only a maximum change (descent) of 166.8 m can be represented in the transmitted dataset. Since the change in depth (delta) between 12:00 and 13:00 is beyond the allowed range, the descent is *limited* to 416.8 m (250 m + 166.8 m). In the final data report, the depth for 13:00 would be identified as 416.8 m, and it would be marked as a **delta limited descent**.



Example 2

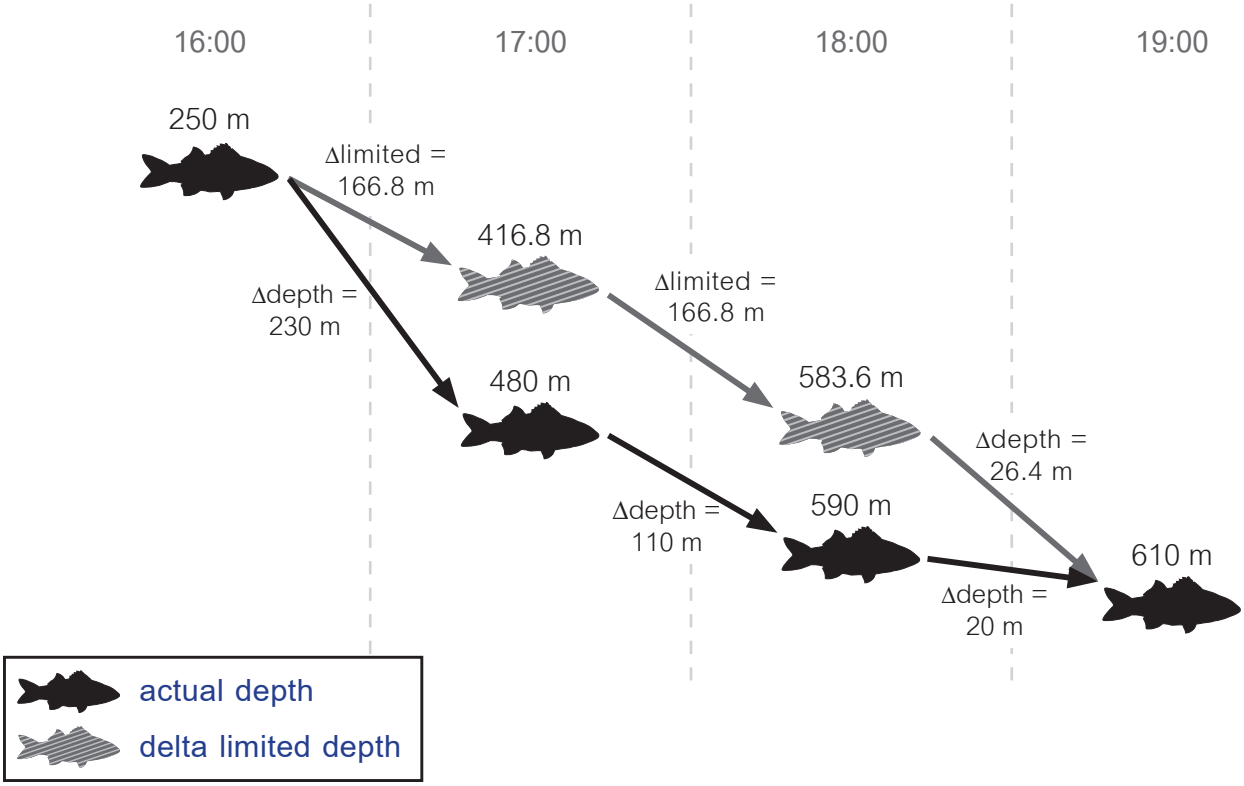
It may take time for delta limited depths to "catch up" to the actual depth. The following illustration shows a sequence of depths over four consecutive hours. In this example, suppose an accurate reference depth is designated at 16:00.

16:00–17:00 The actual change in depth from 16:00 to 17:00 (230 m) is beyond the allowed range (>166.8 m), and therefore, the descent is *limited* to 416.8 m (250 m + 166.8 m).

17:00–18:00 The depth record at 18:00 is calculated relative to the *delta limited depth* (416.8 m) at 17:00. Even though the actual depth difference is only 110 m, the change relative to the delta limited value is beyond the allowed range (>166.8 m). Consequently, the depth at 18:00 is *limited* to 583.6 m (416.8 m + 166.8 m).

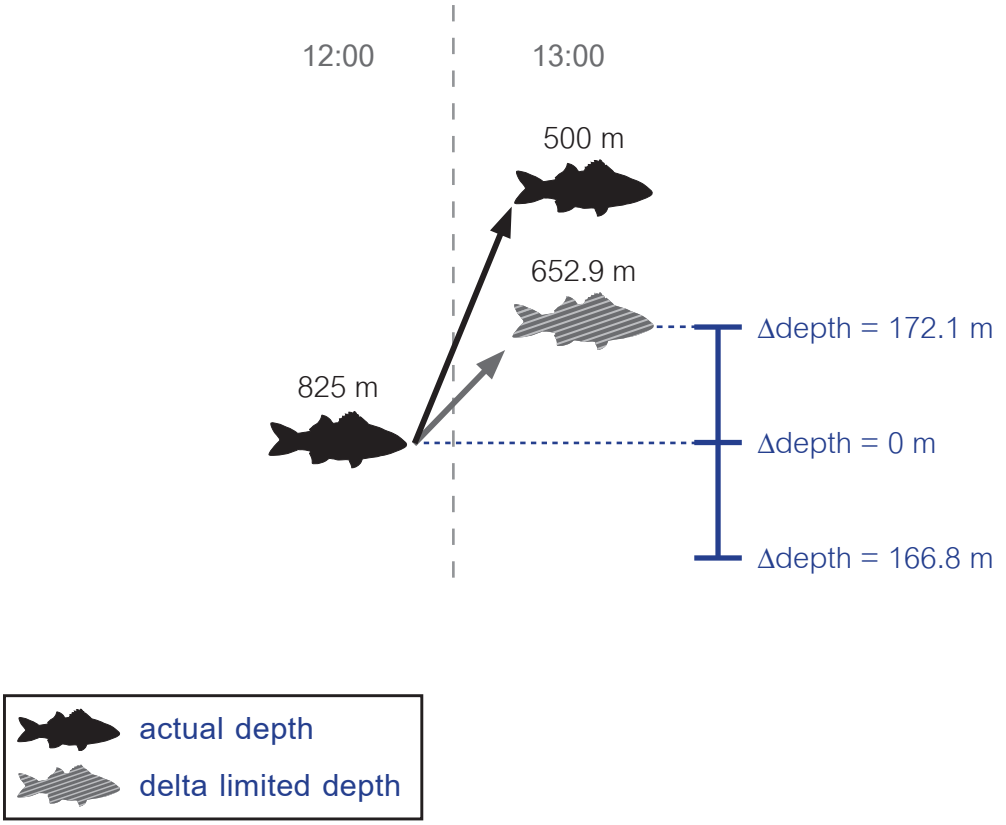
18:00–19:00 The depth record at 19:00 is calculated relative to the *delta limited depth* (583.6 m) at 18:00. The change in depth (26.4 m) is within the allowed range, and therefore, the depth at 19:00 (610 m) is accurately represented. Consequently, at 19:00, the delta limited depth records have caught up with the actual depth records.

In the final data report, the depth records at 17:00 and 18:00 would be marked as **delta limited descents**, signifying that the fish could have been deeper than indicated.



Delta Limited Ascent

Suppose at 12:00 an X-Tag measures a depth of 825 m, and one hour later at 13:00, the fish ascends to a depth of 500 m. This is a depth difference of 325 m, but only a maximum change (ascent) of 172.1 m can be represented in the transmitted dataset. Since the change in depth between 12:00 and 13:00 is beyond the allowed range, the ascent is *limited* to 652.9 m (825 m − 172.1 m). In the final data report, the depth for 13:00 would be identified as 652.9 m, and it would be marked as a **delta limited ascent**.



In summary, if a depth record is identified as a delta limited descent in the transmitted data report, then the actual depth of the fish could have been deeper than the delta limited descent depth.

$$\text{Actual Depth} \geq \text{Delta Limited Descent Depth}$$

If a depth is identified as a delta limited ascent in the transmitted data report, then the actual depth could have been shallower than the delta limited ascent depth.

$$\text{Actual Depth} \leq \text{Delta Limited Ascent Depth}$$

Similar to depth data, there is a limit to the change in temperature that can be accurately represented in the transmitted dataset. If temperature changes beyond the allowed limit, the actual temperature cannot be accurately represented and is identified as **delta limited**. The delta limit for temperature is not a fixed value, but rather the limit depends on the temperature values, varying between 4.84–7.01 °C.

Full-resolution temperatures are designated as a reference for subsequent delta values periodically throughout the day, and delta values are calculated between measurements separated by 60 minutes.

If a temperature record is identified as a delta limited increase in the transmitted data report, then the actual temperature could have been greater than the delta limited increase temperature.

$$\text{Actual Temperature} \geq \text{Delta Limited Increase Temperature}$$

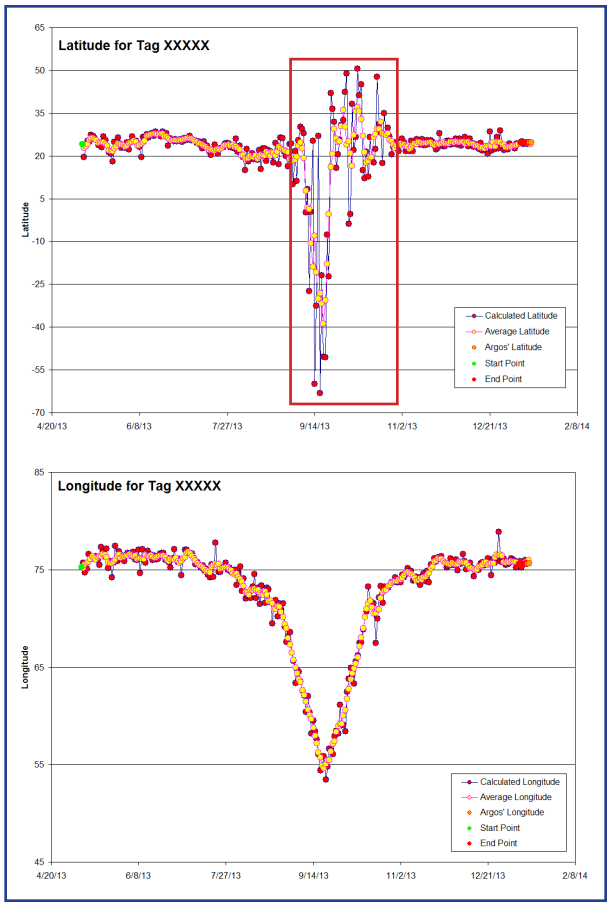
If the temperature record is identified as a delta limited decrease in the transmitted data report, then the actual temperature could have been less than the delta limited decrease temperature.

$$\text{Actual Temperature} \leq \text{Delta Limited Decrease Temperature}$$

Geolocation Estimation

X-Tag Location Estimates

An X-Tag records light levels at two-minute intervals while in data collection mode. A proprietary algorithm is applied to the light-level records in order to estimate daily sunrise and sunset times; these daily sunrise and sunset estimates become part of the transmitted dataset. When a data report is created, daily geolocations are calculated from the sunrise and sunset times.



Longitude is calculated from the time of local noon, halfway between sunrise and sunset. Latitude is calculated from the length of day. Near the vernal and autumnal equinoxes, day length becomes the same at all latitudes so that day length fails to be a distinguishable characteristic between latitudes. **Consequently, light-based latitude estimates near the equinox are not reliable**. In contrast, the reliability of the longitude estimates is not impacted by the equinoxes. Unprocessed latitude and longitude estimates are displayed, illustrating error in latitude estimates approximately one month before and after the autumnal equinox (outlined in red).

Light-based location estimates are prone to error as a result of vertical behavior, time of year, water turbidity, location, etc. In general, longitude estimation is smoother and more reliable than latitude estimation. Given the X-Tag's two-minute, light-level sampling rate, the estimated latitude and longitude points are at best accurate to ±1° for latitude and ±0.5° for longitude.

Normally, latitude locations are calculated within the range of 65°S–65°N, but the bounds may be extended for tag deployments at extreme latitudes. All estimates, independent of their apparent validity, are provided in the data report. Apart from providing the five-day running average of the track, we do not process (filter) the raw light-based locations.

Argos Location Estimates

When a tag is transmitting, the Argos system estimates the tag's position using the Doppler shift of the tag's frequency. Therefore, Argos estimated positions indicate the location of the drifting transmitting tag. Argos attempts to determine the tag's location with each satellite pass, using either Kalman filtering or least-squares processing. Location class (LC) indicates the quality of the position estimate. Please refer to the Argos User's Manual or contact CLS for more information regarding Argos position estimates.

Pop-off Release Mechanism Reasons

The purpose of the release mechanism is to free the tag from the fish, enabling the tag to float to the surface where the transmitted data can reach the constellation of satellites. The release mechanism is initiated by one of four possible triggers: constant pressure, pop-off date reached, memory full, or too-deep emergency release.

Constant Pressure

A tag will release due to the constant-pressure release condition if the tag remains within a prespecified depth range for a fixed duration. Furthermore, a delay can be selected so that the tag will not consider constant pressure for a specified period of time after the removal of the magnet. If requested, the constant-pressure programming can be customized when the tags are ordered to better suit the species under study.

The tag uses the complete set of high-resolution, 2-minute depth records to determine if the constant-pressure release criteria are satisfied. As a result, it may not be apparent in the lower resolution received depth data when the constant-pressure release was or should have been initiated.

Pop-Off Date Reached

When an X-Tag is ordered, the pop-off date (day/month/year) or deployment duration (represented as integer number of months) must be specified. For example, a 9-month tag deployed on March 2, 2014 would release on December 2, 2014, provided the tag did not release prematurely due to another reason (such as constant pressure or too-deep emergency release).

Memory Full

This release mechanism typically only applies to High-Rate tags and indicates that the transmitted dataset is full. Timing of the memory full release trigger depends on the selected deployment duration and designated sampling rate.

Too-Deep Emergency Release

The tag must register depths below the emergency depth threshold (~1296 m) for approximately 15 minutes before the release mechanism is initiated. The tag will not detach instantaneously with the initiation of the release mechanism. Based on our tests, it can take approximately 15–30 minutes (given average salinity) to detach.

The tag uses all the 2-minute archived depth records to determine if the emergency depth release should be initiated. Therefore, the time at which the tag crosses the emergency depth threshold may not be represented in the lower resolution received depth data.

The tag can only represent depths in a range from the surface to approximately

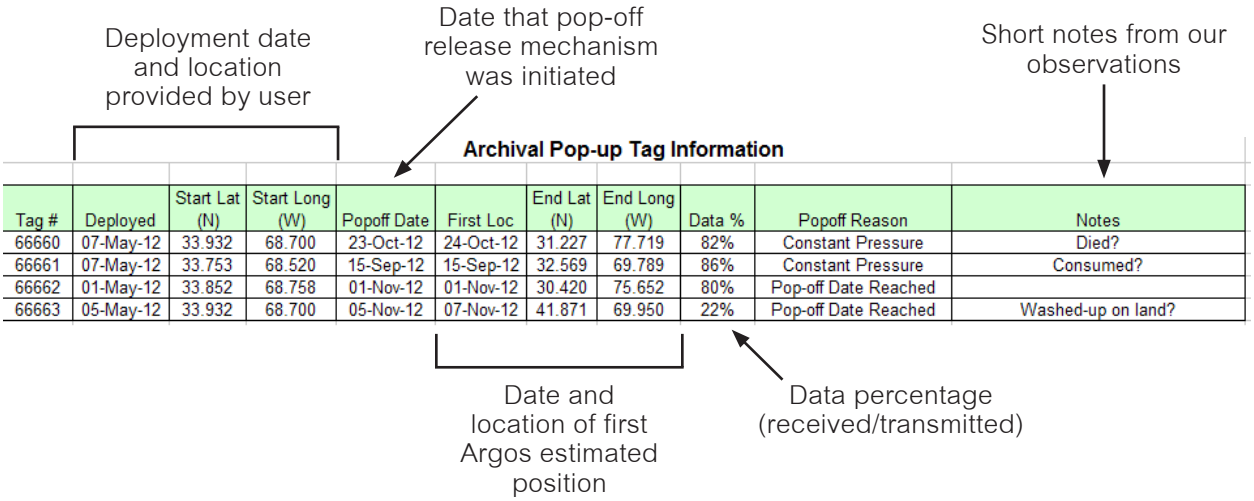
1296 m. Therefore, if a tag descends to 2500 m, the tag would only indicate a maximum depth of approximately 1296 m.

While the crush depth of X-Tags exceeds 2500 m, please alert us prior to ordering if your study animal uses depths >1300 m.

Part II: Data Reports

Tag Information Summary

Every set of reports is accompanied by a "TagInfo" Excel file (.xls) that displays and summarizes important tag information.



Tag #	Deployed	Start Lat (N)	Start Long (W)	Popoff Date	First Loc	End Lat (N)	End Long (W)	Data %	Popoff Reason	Notes
66660	07-May-12	33.932	68.700	23-Oct-12	24-Oct-12	31.227	77.719	82%	Constant Pressure	Died?
66661	07-May-12	33.753	68.520	15-Sep-12	15-Sep-12	32.569	69.789	86%	Constant Pressure	Consumed?
66662	01-May-12	33.852	68.758	01-Nov-12	01-Nov-12	30.420	75.652	80%	Pop-off Date Reached	
66663	05-May-12	33.932	68.700	05-Nov-12	07-Nov-12	41.871	69.950	22%	Pop-off Date Reached	Washed-up on land?

The deployment date and location are provided by the user prior to data processing.

The pop-off date column indicates the date of the pop-off release mechanism initiation which may not necessarily match the date of the first Argos location.

The data percentage indicates the amount of data *received* relative to the *transmitted* dataset.

Report Components

A data report is an Excel file (.xls) containing a series of maps, datasheets, and charts that display and organize the received dataset.

Map

The map displays the tag's estimated light-based geolocations (bright blue) and a five-day running average (purple). The deployment location (green), first Argos location (red), and subsequent Argos locations (from the drifting transmitting tag; yellow) are displayed.

Sunrise and Sunset Times

This datasheet contains the tag's estimated daily sunrise and sunset times (GMT). The corresponding depths at these times (5.4 m resolution) are provided.

Latitude Plot / Longitude Plot

The tag's daily latitude and longitude estimates (red) are independently displayed versus time, and the five-day running average (yellow) is included. The deployment location (green), first Argos location (red), and subsequent Argos locations (from the drifting transmitting tag; orange) are displayed.

Lat&Long

This datasheet contains the tag's daily estimated geolocations and the five-day running average values. The estimated latitude and longitude points are at best accurate to ±1° for latitude and ±0.5° for longitude. Typically latitude locations are calculated within the range of 65°S–65°N, but the bounds may be extended for tag deployments at extreme latitudes.

Deployment information (provided by the user) and first Argos date and location are included. The pop-off release mechanism reason is indicated. The data percentage indicates the amount of data received relative to the complete transmitted dataset.

Combined Chart / Combined Chart (MinMax) / Press Chart / Press Chart (MinMax) / Temp Chart / Temp Chart (MinMax) / Light Chart (MinMax)

These charts display time-series depth, temperature, and light-level data in various combinations. Delta limited depth and temperature values are indicated in all applicable charts.

Press Data

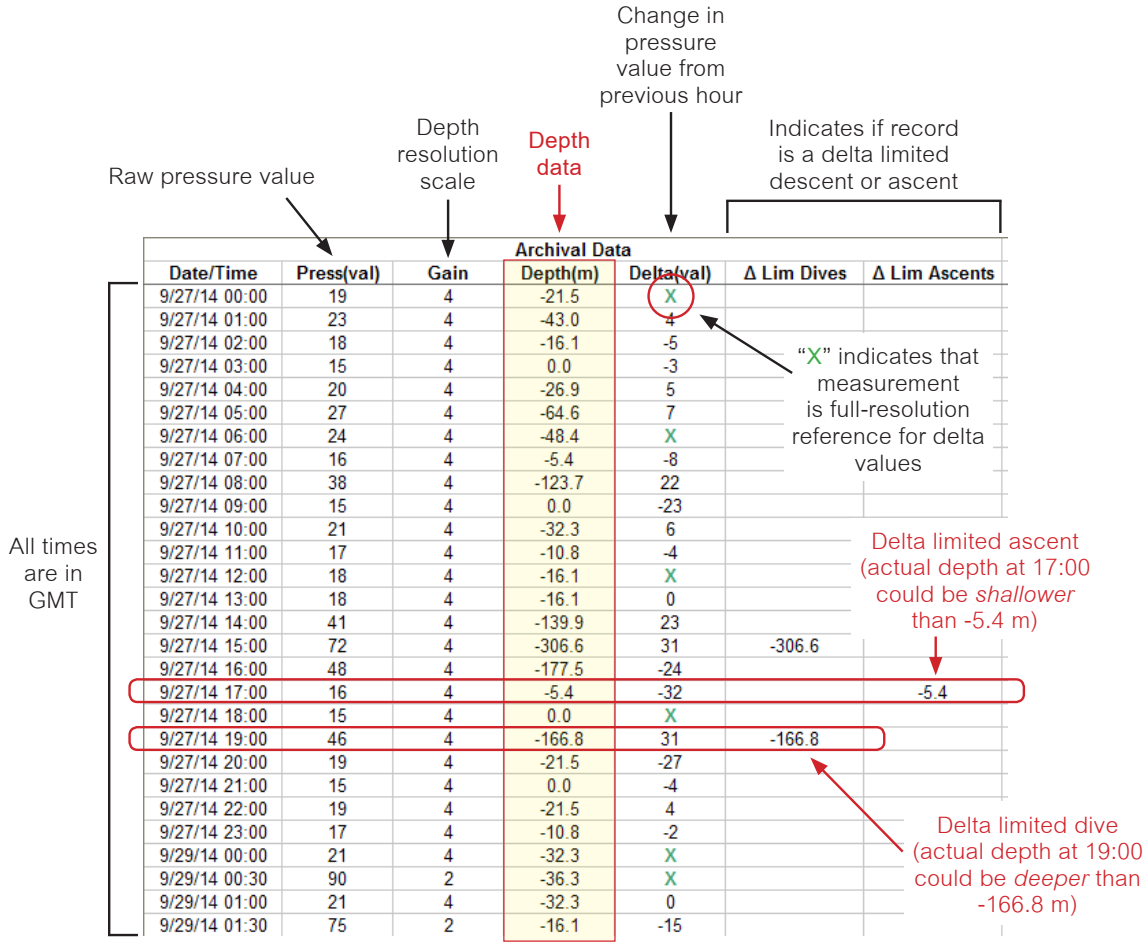
This datasheet contains the time-series depth records, including real-time depth data. Data are sorted by date and time starting at the beginning of deployment.

Depth resolution varies between 0.34–5.38 m. The resolution of a given measurement is specified by the "gain" scaling factor. X-Tags can represent depths in the range 0–1296 m, although this maximum depth may vary slightly between tags.

Gain	Depth Resolution (m)
0	0.34
1	0.67
2	1.34
3	2.69
4	5.38

Column	Column Title	Description
A	Date/Time	Date and time of depth record (GMT)
B	Press(val)	Raw pressure value (no units)
C	Gain	Depth resolution scaling factor
D	Depth(m)	Depth in units of meters
E	Delta(val)	Difference in pressure value from previous hour; "X" indicates accurate reference value
F	ΔLim Dives	Delta limited descents
G	ΔLim Ascents	Delta limited ascents
I	Date/Time	Date and time of real-time depth record (GMT)
J	Press(val)	Raw pressure value (no units)
K	Depth(m)	Depth in units of meters (1.34 m resolution)

The figure below displays depth data as presented in a fish data report (columns A–G).



Date/Time	Press(val)	Gain	Depth(m)	Delta(val)	Δ Lim Dives	Δ Lim Ascents
9/27/14 00:00	19	4	-21.5	X		
9/27/14 01:00	23	4	-43.0	-4		
9/27/14 02:00	18	4	-16.1	-5		
9/27/14 03:00	15	4	0.0	-3		
9/27/14 04:00	20	4	-26.9	5		
9/27/14 05:00	27	4	-64.6	7		
9/27/14 06:00	24	4	-48.4	X		
9/27/14 07:00	16	4	-5.4	-8		
9/27/14 08:00	38	4	-123.7	22		
9/27/14 09:00	15	4	0.0	-23		
9/27/14 10:00	21	4	-32.3	6		
9/27/14 11:00	17	4	-10.8	-4		
9/27/14 12:00	18	4	-16.1	X		
9/27/14 13:00	18	4	-16.1	0		
9/27/14 14:00	41	4	-139.9	23		
9/27/14 15:00	72	4	-306.6	31	-306.6	
9/27/14 16:00	48	4	-177.5	-24		
9/27/14 17:00	16	4	-5.4	-32		-5.4
9/27/14 18:00	15	4	0.0	X		
9/27/14 19:00	46	4	-166.8	31	-166.8	
9/27/14 20:00	19	4	-21.5	-27		
9/27/14 21:00	15	4	0.0	-4		
9/27/14 22:00	19	4	-21.5	4		
9/27/14 23:00	17	4	-10.8	-2		
9/29/14 00:00	21	4	-32.3	X		
9/29/14 00:30	90	2	-36.3	X		
9/29/14 01:00	21	4	-32.3	0		
9/29/14 01:30	75	2	-16.1	-15		

Press Data (MinMax)

This datasheet displays daily minimum and maximum depth records determined from the tag's 2-minute archived dataset. Columns B–C contain raw pressure values and columns D–E contain depth records measured in meters.

The resolution of daily minimum and maximum records is consistently 5.38 m (gain 4). Given that the resolution of the transmitted time-series (15–60 minute) records varies between 0.34–5.38 m, it is possible for the received time-series records to be slightly shallower or deeper than the daily minimum and maximum records, respectively. Similarly, the fish's actual daily depth use could be slightly shallower or deeper than the reported minimum and maximum values, respectively.

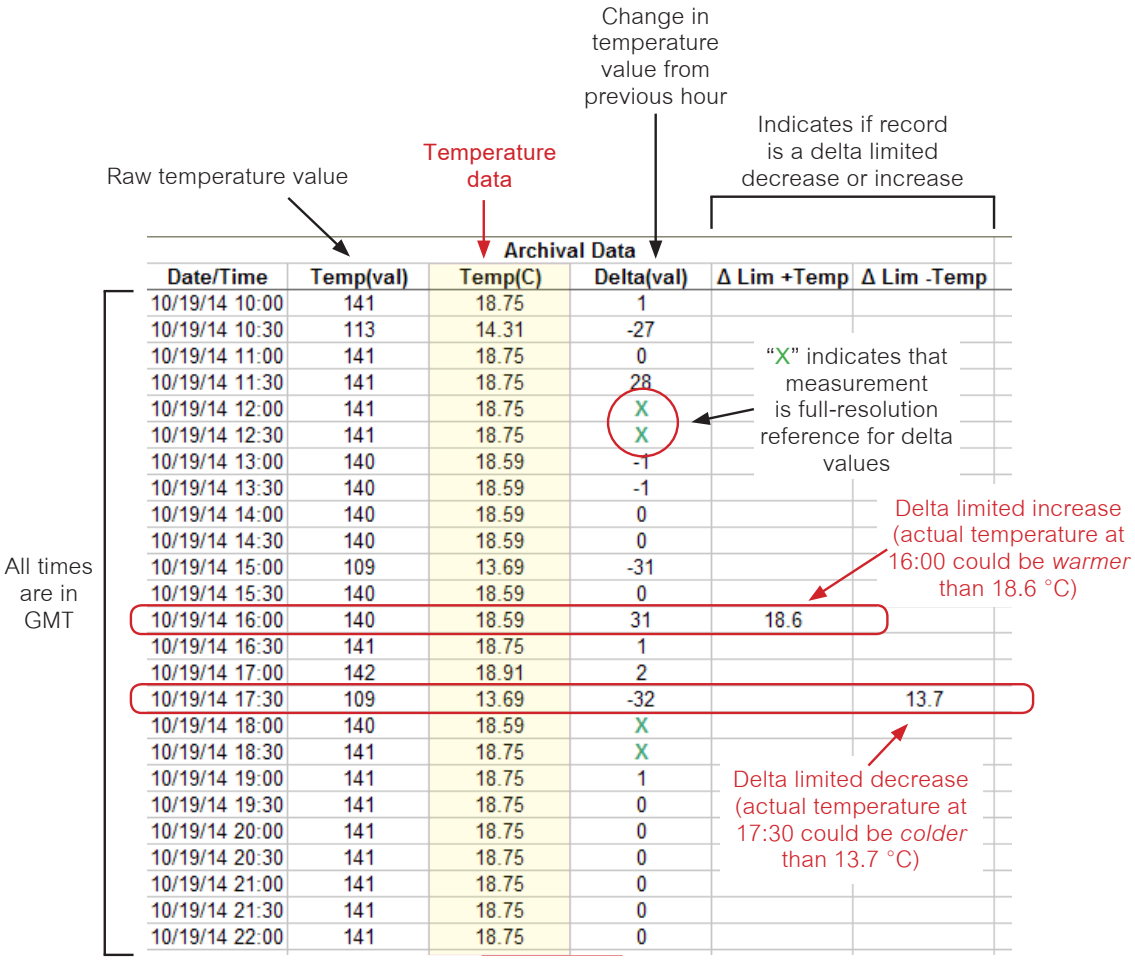
Temp Data

This datasheet contains received temperature records, including real-time temperature data. Data are sorted by the date and time starting at the beginning of the deployment.

Temperature resolution varies between 0.16–0.23 °C depending on the temperature. The tag can capture temperatures in the range −4–40 °C.

Column	Column Title	Description
A	Date/Time	Date and time of temperature record (GMT)
B	Temp(val)	Raw temperature value (no units)
C	Temp(C)	Temperature in units of degrees Celsius
D	Delta(val)	Difference in temperature value from previous hour; "X" indicates accurate reference value
E	ΔLim +Temp	Delta limited increase
F	ΔLim -Temp	Delta limited decrease
H	Date/Time	Date and time of real-time temperature record (GMT)
I	Temp(val)	Raw temperature value (no units)
J	Temp(C)	Temperature in units of degrees Celsius

The following illustration displays temp data as presented in a fish data report (columns A–F).



Temp Data (MinMax)

This datasheet displays daily minimum and maximum temperature records determined from the 2-minute archived dataset. Columns B–C contain raw temperature values and columns D–E contain temperature records measured in degrees Celsius.

Light Data (MinMax)

This datasheet displays daily minimum and maximum light levels, determined from the tag's 2-minute archived dataset, and real-time light levels. These values do not have units. Full light saturation corresponds to 255.

Argos Data

This datasheet contains the Argos estimated positions of the *transmitting* tag. The "LC" ("Location Class") column indicates the quality of the position estimate with 3 being the best and Z representing the lowest quality (order in decreasing quality: 3, 2, 1, 0, A, B, and Z).

When a tag is in transmission mode, Argos estimates the tag's position based on the Doppler shift of the tag's frequency during each satellite pass. Argos uses Kalman filtering or least-squares processing for estimating positions. Please refer to the Argos User's Manual or contact CLS for more information regarding Argos position estimates.

Text Files

Each report is accompanied by text files (.txt) containing the received dataset. Most information is organized in the Excel file. Shaded information is not included in the Excel file.

a-File (xxxxxa.txt)

This file contains the Argos locations estimated during data transmission phase.

1	**Date/Time**	Date and time (GMT)
2	**Location**	Quality of Argos location
3	**Latitude (1)**	Latitude (°N)
4	**Longitude (1)**	Longitude (°W)
5	**Latitude (2)**	Latitude (°N) (mirror image location should be disregarded)
6	**Longitude (2)**	Longitude (°W) (mirror image location should be disregarded)

e-File (xxxxxe.txt)

This file contains daily summary data including sunrise/sunset times and daily minimum/maximum temperature, pressure, and light-levels records.

1	**Date**	Date
2	**SR min**	Time (GMT) of sunrise in minutes (out of 1440 minutes in the day); 2047 indicates that no sunrise was determined
3	**SR Time**	Time (GMT) of sunrise (hours:minutes)
4	**SS min**	Time (GMT) of sunset in minutes (out of 1440 minutes in the day); 2047 indicates that no sunset was determined
5	**SS Time**	Time (GMT) of sunset (hours:minutes)
6	**Min Light**	Daily minimun light level (hexadecimal)

7	**Max Light**	Daily maximum light level (hexadecimal)
8	**Min Press**	Daily minimum pressure value (hexadecimal)
9	**Max Press**	Daily maximum pressure value (hexadecimal)
10	**Min Temp**	Daily minimum temperature value (hexadecimal)
11	**Max Temp**	Daily maximum temperature value (hexadecimal)
12	**SR Press**	Pressure value at time of sunrise (hexadecimal)
13	**SS Press**	Pressure value at time of sunset (hexadecimal)

o-file (xxxxxo.txt)

This file contains the real-time data from data transmission phase.

1	**Date/Time**	Time registered by tag at time of transmission (GMT)
2	**Real Time**	Time registered by Argos at time of transmission (GMT)
3	**Temp**	Real-time temperature records
4	**Batt.**	Real-time battery values
5	**Press**	Real-time pressure records
6	**Light**	Real-time light-level records
7	**Tx Cnt**	Transmission counter (loops 0–31)
8	**Tx Mode**	Transmission mode (0 indicates continuous transmission and 1 indicates transmission only in Satellite-in-View [SiV] windows)
9	**Midnight**	Calculated daily midnight (GMT)
10	**SR Cnt**	Number of days since tag has registered a sunrise (0–15)
11	**SS Cnt**	Number of days since tag has registered a sunset (0–15)
12	**Pop Reason**	Code for pop-off release mechanism initiation reason
13	**Pop Day**	Date of pop-off release mechanism initiation (GMT)
14	**Pop Time**	Time of pop-off release mechanism initiation (GMT)

p-file (xxxxxp.txt)

This file contains time-series pressure data

1	Date and time (GMT)
2	Pressure value
3	Gain scaling factor

rp-file (xxxxxrp.txt)

This file contains real-time pressure records from data transmission phase (same pressure records as o-file)

1	Date and time (GMT)
2	Real-time pressure records

rt-file (xxxxxrt.txt)

This file contains real-time temperature records from data transmission phase (same temperature records as o-file).

1	Date and time (GMT)
2	Real-time temperature records

t-file (xxxxxt.txt)

This file contains time-series temperature data.

1	Date and time (GMT)
2	Temperature value

Measurement Resolution Summary

Measurement	Resolution	Range
Time-series depth records	*0.34–5.38 m	0–1296 m (approximate maximum depth)
Real-time depth records	1.34 m	Not applicable. Real-time data only received if tag is at the surface (0 m).
Min/Max depth records	5.38 m	0–1296 m (approximate maximum depth)
Time-series temperature records	*0.16–0.23 °C	-4–40 °C
Real-time temperature records	0.16–0.23 °C	-4–40 °C
Min/Max temperature records	0.16–0.23 °C	-4–40 °C
Latitude estimates	±1° (at best)	65°S–65°N
Longitude estimates	±0.5° (at best)	-180°W–180°W
Sunrise/Sunset Depth	5.38 m	0–1296 m (approximate maximum depth)

*Record could be delta limited, and consequently, the measurement error may greatly exceed resolution.