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ECD-DEPTH

The EDC-Depth data product provides information about the depths visited by the animal during a summary period. ECD (Empirical Cumulative Distribution) estimates the cumulative distribution of the data collected from tagged animals and describes the independent probabilities that the depth visited by the animal will have a value less than or equal to a certain percentage (X%). For example, if the minimum depth reported 0 m and the 25% ECD value is 15 m, then the animal spent 25% of that summary period between 0-15 m.

This data product is ideal for those interested in dive behavior but want to avoid the gaps that can occur with high-resolution data products like Behavior Log or Depth Time Series, and it provides a more fine-scale resolution than what is possible with Histograms. It is also ideal if you do not fully understand the dive behavior of your study species because you do not need to set pre-defined bin limits like you do with Histograms. It is important to note there are multiple "flavors" of ECD, and the way the depth data are collected and summarized will differ between tag types. All ECD-Depth data are reported in the ECD-Histos.csv file.

SPLASH-F-391

Tags Containing This Data Product
SPLASH-F-391

Depth data will be collected at 1 Hz and a summary period will be used to split the data into informative chunks of time. There are two parameters that must be configured when programming the tag:

1. Summary period (this defaults to 24 hr.).
2. Depth Threshold to separate "shallow" and "deep" (this defaults to 30 meters).

Two distinct ECDs will be collected for every summary period—one for the shallow portion of the water column and one for the deep portion of the water column. The boundary between shallow and deep are configurable. The boundary is inclusive of the upper bound for the shallow depths. For example, if the shallow threshold is set to 30 meters, all depths between 0.0 meters - 30.0 meters are counted in the "Shallow ECD" and all depths 30.1 meters - max. depth are counted in the "Deep ECD." The Shallow ECD reports the 33rd, 66th, and 100th percentiles. The Deep ECD reports the 20th, 40th, 60th, 80th, and 100th percentiles.

Transmitted Data

Every message contains ECD data for two consecutive summary periods (two pairs of shallow/deep ECDs). Each set of ECDs will also contain a count of dives that met the configured dive definition (with a max count of 127) and a percent dry. The Percent Dry is calculated as the summary period minus the time spent in the shallow and deep zones. The timestamp of the message indicates the start of the first ECD pair, and the second ECD pair always immediately follows the first. Using the percent time spent shallow and deep, an overall ECD of the depths visited by the tag can be created.

Start	End	Kind	Type	MinDepth	PercentTime	MinSec	MaxSec	MaxDives	Percent_20	Percent_33	Percent_40	Percent_60	Percent_66	Percent_80	Percent_100
5/2/2012 21:00	5/2/2012 22:00	depth	dry		100										
5/2/2012 22:00	5/2/2012 23:00	depth	dry		100										
5/2/2012 23:00	5/3/2012 0:00	depth	shallow	0	44.1			1		1			3		15
5/2/2012 23:00	5/3/2012 0:00	depth	deep		2.4			1	19		26	34		38	39
5/2/2012 23:00	5/3/2012 0:00	depth	dry		53.5										
5/3/2012 0:00	5/3/2012 1:00	depth	shallow	0	19.7			1		1			2		15
5/3/2012 0:00	5/3/2012 1:00	depth	deep		1.6			1	20		24	25		26	29
5/3/2012 0:00	5/3/2012 1:00	depth	dry		78.7										

ECD-DEPTH – CONTINUED

An example of an ECD with a one-hour summary period is shown above. The first two lines would indicate that the animal is hauled-out on land, or the tag is dry 100% of the time. During the 23:00 hour, the animal spent 44.1% of the hour in the shallow zone, 2.4% of the time deep, and 53.5% of the time dry. While in the shallow zone, the animal was never deeper than 15 meters (the threshold depth) and spent 66% of the hour at or below 3 meters, and 33% of the time at or below 1 meter.

While in the deep zone, the animal was never deeper than 39 meters, spent 80% of the time at or below 38 meters, 60% of the time at or below 34 meters, 40% of the time at or below 26 meters, and 20% of the time at or below 19 meters. The animal performed one dive during this summary period (1 hr.).

Special Cases

This data product looks at multiple types of data: wet and dry, shallow and deep. If the tag does not record all of the potential data types, the ECD message is still transmitted, but the structure of the message may vary slightly. Below are some examples of special cases and how the data will be reported:

1. Instrument is dry and at the surface for the entire summary period: If this is the case, then no depth reading is taken, and the sample is marked as dry. An ECD message will be sent, but it will not contain ECD-depth data. This message would contain the dive count, minimum depth, and time stamps.
2. The animal makes ONLY shallow dives and never passes the "deep" threshold: In this scenario, there will be no depth samples in the "deep" ECD. The final ECD message will indicate that the deep ECDs are absent but the shallow ECDs will be sent, along with the dive count and minimum depth.

The animal is in the "deep" zone for an entire summary period: If the animal never enters the shallow zone, then there will be no depth samples in the shallow ECD. The final ECD message will indicate that the shallow ECDs are absent, but the deep ECDs will be sent. The dive count and minimum depth will be included in the message.

There will always be a record of time spent in each zone (dry, shallow, deep) as part of the ECD data product. If an ECD is absent (no depth samples taken), then it is implied that no time was spent in that zone. The data are reported in the Histos-ECD.csv file.

SCOUT-Temp

Tags Containing This Data Product
SCOUT-Temp

During each summarization period, the tag builds an ECD of depth AND temperature, which are both sampled every two seconds. The summary period is configurable.

The data for this ECD contains the minimum and maximum observed values, as well as the 25%, 50%, and 75% distribution values for depth and temperature. Depth is reported in 1 m increments, temperature in 0.1° C increments.

ECD-DEPTH – CONTINUED

microPAT

Tags Containing This Data Product
microPAT

The data for this ECD contains the minimum and maximum depths encountered, as well as the 25%, 50%, and 75% distribution values for depth. These represent the depth above which (i.e., "shallower than") the animal spent its time during a fixed 6-hour summary periods. The summary period on microPAT is NOT configurable and is fixed at 6 hours.

The microPAT also provides the maximum temperature encountered during the summary period for each ECD depth. These temperature-depth pairs result in a behaviorally driven temperature profile for each summary period.

Note: Due to limited bandwidth, the microPAT will attempt to send ECDs and temperature profiles for three out of the four 6-hour summary periods per day at random. Meaning that for a tag that performs as designed, and transmits seven hundred total data messages post-release, one should expect to receive 75% of the deployment's ECD data messages. Those transmitted data products can be found in the -ECDHistos.csv (depths) and -PDTs.csv (temperatures) files upon download from the Portal.

Transmitted Data

Every transmitted data message contains one 6-hour ECD summary (with the maximum temperature encountered at each depth), paired with a light curve. The 'Start' timestamp of the message indicates the Date and Time when the 6-hour summary period began. An example of the ECD depths is below.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	DeployID	Ptt	Source	Instr	Start	End	Kind	Type	MinDepth	PercentTime	MinSec	MaxSec	MaxDives	Percent_25	Percent_50	Percent_75	Percent_100	
4	236229	236229	Transmissi	UT	2/23/2023 9:00	2/23/2023 15:00	depth	observed	-1					14	15	15	16	
5	236229	236229	Transmissi	UT	2/23/2023 15:00	2/23/2023 21:00	depth	observed	-1					8	12	13	15	
6	236229	236229	Transmissi	UT	2/23/2023 21:00	2/24/2023 3:00	depth	observed	0					3	4	5	8	
7	236229	236229	Transmissi	UT	2/24/2023 3:00	2/24/2023 9:00	depth	observed	-1					2	6	10	14	
8	236229	236229	Transmissi	UT	2/24/2023 9:00	2/24/2023 15:00	depth	observed	5					11	13	14	15	
9	236229	236229	Transmissi	UT	2/24/2023 15:00	2/24/2023 21:00	depth	observed	0					14	15	15	16	
10	236229	236229	Transmissi	UT	2/25/2023 3:00	2/25/2023 9:00	depth	observed	-1					0	1	5	20	
11	236229	236229	Transmissi	UT	2/25/2023 9:00	2/25/2023 15:00	depth	observed	1					3	23	24	26	
12	236229	236229	Transmissi	UT	2/25/2023 21:00	2/26/2023 3:00	depth	observed	1					20	25	28	34	
13	236229	236229	Transmissi	UT	2/26/2023 3:00	2/26/2023 9:00	depth	observed	0					5	7	14	40	
14	236229	236229	Transmissi	UT	2/26/2023 15:00	2/26/2023 21:00	depth	observed	31					43	45	46	49	
15	236229	236229	Transmissi	UT	2/26/2023 21:00	2/27/2023 3:00	depth	observed	4					10	42	45	50	
16	236229	236229	Transmissi	UT	2/27/2023 9:00	2/27/2023 15:00	depth	observed	6					23	45	50	54	
17	236229	236229	Transmissi	UT	2/27/2023 21:00	2/28/2023 3:00	depth	observed	-1					32	40	42	46	
18	236229	236229	Transmissi	UT	2/28/2023 3:00	2/28/2023 9:00	depth	observed	0					1	11	21	41	

ECD-DEPTH – CONTINUED

Special Cases

The 6-hour summary period is fixed, but you can program an offset. The offset is the number of hours after UTC 00:00 that you want your summary periods to begin. Use this to choose summary periods based on the local time of day. It is most useful when you know the animal you tag will stay close to the same longitude during the deployment and want the ECD message to synchronize to local time. We do not recommend setting an offset if your animal may migrate long distances east or west, or if their migratory behavior is unknown.

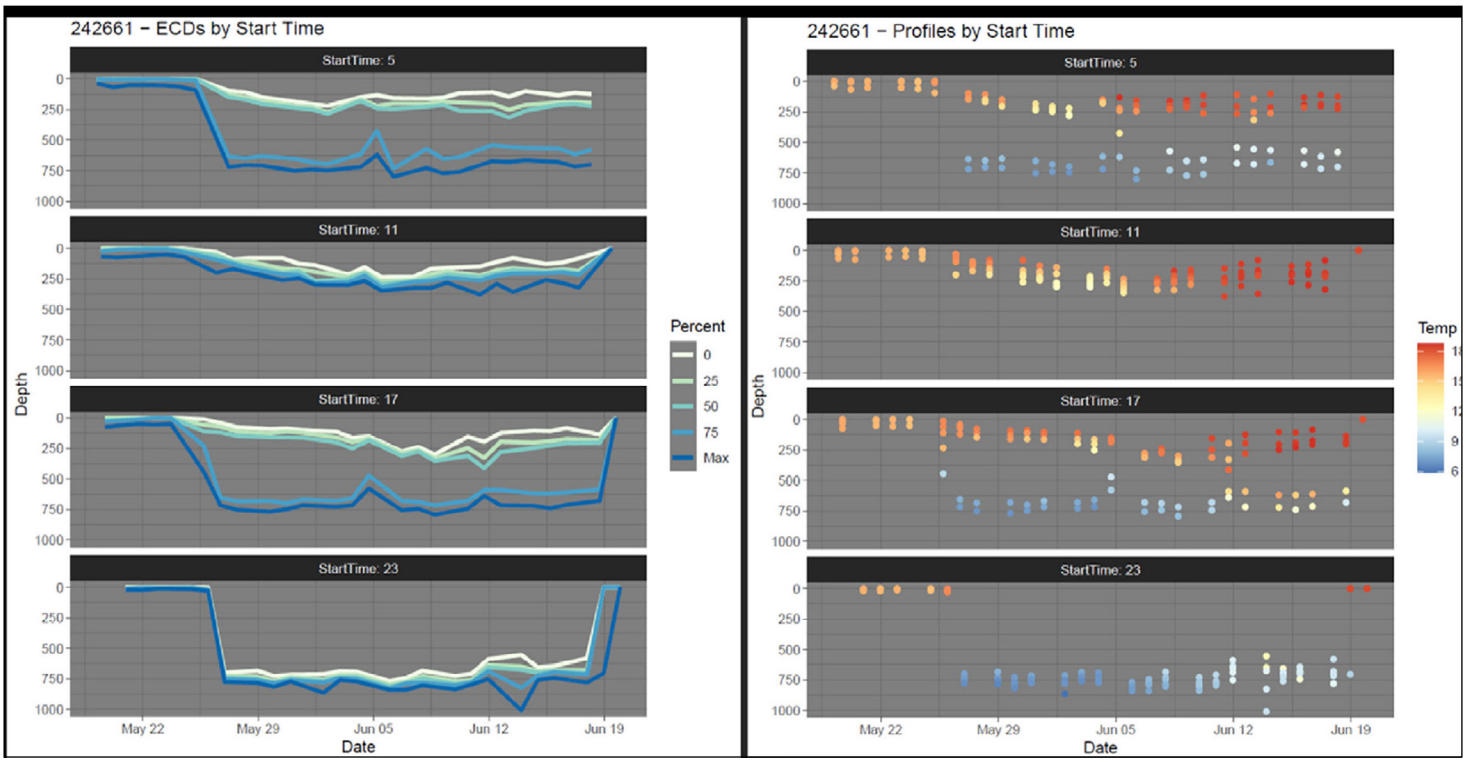

Figure 2 —R- visual: ECD and temperature profiles at the ECD depths at 6-hour summary periods - for WC Beta Trial PTT 242661 – depicting distinct diurnal movement. In this example, the period starting at 23:00 is daytime, centered on local noon, and the period starting at 11:00 is nighttime.