ECD-DEPTH

ECD is an acronym for an **Empirical Cumulative Distribution** function. In statistics, an empirical distribution function is an estimate of the cumulative distribution that generated the points in the "sample." For this data product, it represents the depths visited by the tag/animal. This is ideal for people interested in dive behavior or determining behavior states of animals at sea but want to avoid gaps that can occur when transmitting a "Behavior Log."

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 the 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 - 30.1 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										

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 meters.

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 any depth ECD 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.