**LTSA File Format**

Long-Term Spectral Averages (LTSAs) are a condensed spectrogram-based index summarizing a large number of XWAV files. Five second averages are computed from a series of XWAV files, and stored as a data summary.

LTSA files (.ltsa) are binary files which can be read using functions contained within the freely available [*Triton* software package](https://github.com/MarineBioAcousticsRC/Triton) (available for MATLAB-based or [standalone](https://github.com/MarineBioAcousticsRC/Triton-Compiled) configurations). In particular, **read\_ltsa.m** (which can be opened with a standard text editor) details the structure of an LTSA file and imports it into a data structure. LTSA files can be displayed and used to efficiently explore recordings in Triton, but they must be kept in the folder with the data that they refer to. Problems will arise when the XWAV data and LTSAs are stored separately. If the organization of the data changes, LTSA files can be remade in Triton.

LTSA files have the following general layout:

|  |  |  |
| --- | --- | --- |
| 1 LTSA file | LTSA header | Standard LTSA header |
| Raw File details |
| Data | Data Chunk 1 |
| Data Chunk 2 |
| . . . |
| Data Chunk N |

Detailed layout within the LTSA headers is as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Field Name | Length in Bytes | Start | End | Format | # of Elements | Example |
| **Standard LTSA header** | | | | | | | |
| Basic  Header | type (file ID type) | 4 | 0 | 3 | uchar | 4 | “LTSA” |
| ver (version number) | 1 | 4 | 4 | uint8 | 1 | 4 |
| spare | 3 | 5 | 7 | uchar | 3 |  |
| dirStartLoc (directory start location) | 4 | 8 | 11 | uint32 | 1 | 65 |
| dataStartLoc (data start location) | 4 | 12 | 15 | uint32 | 1 | 6777120 |
| tave (time bin average for spectra [sec]) | 4 | 16 | 19 | float32 | 1 | 5 |
| dfreq (frequency bin size [Hz]) | 4 | 20 | 23 | float32 | 1 | 100 |
| fs (sample rate [Hz]) | 4 | 24 | 27 | uint32 | 1 | 200000 |
| nfft (# of samples per FFT) | 4 | 28 | 31 | uint32 | 1 | 2000 |
| nrftot (# of raw files from all xwavs) | 4 | 32 | 35 | uint32 | 1 | 65064 |
| nxwav (# of xwav files used) | 2 | 36 | 37 | uint16 | 1 | 2169 |
| ch (# of ltsa channels) | 1 | 38 | 38 | uint8 | 1 | 1 |
| spare | 25 | 39 | 64 | uchar | 25 |  |
| **SUBTOTAL** |  | **64** | **0** | **64** |  |  |  |
| **Additional LTSA header**  *Repeated for each RawFile(k) for k= 1: nrftot* | | | | | | | |
| Raw file details | year | 1 | 65 | 65 | uchar | 1 | “20” |
| month | 1 | 66 | 66 | uchar | 1 | “8” |
| day | 1 | 67 | 67 | uchar | 1 | “1” |
| hour | 1 | 68 | 68 | uchar | 1 | “22” |
| minute | 1 | 69 | 69 | uchar | 1 | “30” |
| seconds | 1 | 70 | 70 | uchar | 1 | “0” |
| milliseconds | 2 | 71 | 72 | uint16 | 1 | 0 |
| byteloc (byte location of this raw file’s spectral averages) | 4 | 73 | 76 | uint32 | 1 | 1 |
| nave (# of spectral averages for this raw file) | 4 | 77 | 80 | uint32 | 1 | 6777120 |
| fname (xwav name for this raw file) | 80 | 81 | 160 | uchar | 80 | 'GOM\_MR\_01\_200826\_222200.x.wav’ |
| rfileid (raw file ID number) | 4 | 161 | 164 | uint32 | 1 | 1 |
| padding | 4 | 165 | 168 | uchar | 4 |  |
| **SUBTOTAL** |  | **104** | **65** | **168** |  |  |  |