ADEON FSAS README FILE:
Cruise EN626 Nov 2018 Products from Vessel-based Fine Scale Acoustic Surveys (FSAS)

Cruise specific data collection alerts
Because of rough sea states, we were unable to complete FSAS surveys at the VAC, HAT, and CHB sites. We were able to complete a 2nd FSAS at the JAX site, the 2nd survey was the same grid as the first one, but at a different time.

Exports of FSAS acoustic data from ADEON Phase III cruise

Each .csv file is a single transect line. The naming convention of each file is as follows, with underscores separating each component:

GLO = ADEON
Cruise = two character 3 digit code (EN626)
Site = three letter site code (BLE, etc.)
FSAS number = Assigned FSAS number per cruise, as listed in each cruise log
Line number = Assigned transect number per FSAS survey, as listed in cruise diary
Freq = three digit frequency followed by a "k"
Export bin dimensions = 005mvert_100mhorz

Each export contains the following data:

Process ID = ID number per export
Interval = Bin column
Layer = Bin row
Sv_mean = Mean Sv integrated over cell
NASC = per cell
Height_mean = mean vertical extent of cell
Depth_mean = mean depth per cell
Layer_depth_min
Layer_depth_max
Ping_S = Cell starting ping number
Ping_E = Cell ending ping number
Dist_M = GPS-measured distance from first ping to middle ping of the cell
Date_M = Date of middle ping of the cell
Time_M = Time of middle ping of the cell
Lat_M = Latitude
Lon_M = Longitude
Noise_Sv_1m = Background noise at 1m (dB re $1m^2/m^3$)
Minimum_Sv_threshold_applied = Binary; 1 if a threshold was applied, 0 if otherwise
Maximum_Sv_threshold_applied = Binary; 1 if a threshold was applied, 0 if otherwise
Standard_deviation = St. dev. of all sample values in the cell
Thickness_mean = mean extent along the beam axis of cell
Range_mean = mean linear distance from center of transducer of cell
Exclude_below_line_range_mean = mean range of the exclude-below line for cell interval (the bottom line)
Exclude_above_line_range_mean = mean range of the exclude-above line for cell interval (the surface exclusion line)

FSAS Data Processing Steps

A total of five fine scale acoustic surveys (FSAS) were conducted on the EN626 cruise. Each FSAS was composed of 4 to 9 transects running across an approximately 10km^2 area centered on the lander at four of the ADEON sites. All FSAS data from the EN626 cruise has been processed using Echoview software, as described below.

For each site (VAC, HAT, etc.), water column sound speed and absorption coefficient (for EK60 variable) or temperature and salinity used to calculate the absorption coefficient (for EK80 variables) were edited to reflect mean midwater environmental parameters derived from conductivity, temperature, and depth (CTD) profile data. Calibration offsets were added to all EN626 calibration settings based on a shipboard calibration done during EN615 for all frequencies.

For the EN626 data, transducer depth was set to 1 m below the surface. A surface exclusion line was placed at 10 m depth for all files and adjusted to ensure backscatter from bubble intrusion, etc were excluded. For all files, bottom-detection lines were automatically generated using the lowest-frequency data (38 kHz). These bottom lines were visually examined and edited for errors and then applied to data from all other frequencies. A bottom offset exclusion line was generated at one meter above the bottom line, to ensure that no backscatter from the seafloor was included in the water column data.

The removal of ambient, background, and self-noise was a multistep process conducted in Echoview. Once areas above the surface line and below the bottom line were excluded, time-varied gain (TVG) noise was removed using the data generator operand to virtually generate TVG noise stripes for each frequency based on the S_V value at 1 m. The S_V value at 1 m was determined by scrutiny of the TVG evident on passive noise files recorded during each cruise, with adjustments based on the data files. For the EN626 data, the S_V values at 1 m were: -145 dB for 38 kHz, -133 for 70 kHz, -132 dB for 120 kHz, and -128 dB for 200 kHz. This variable allowed much of the TVG noise to be subtracted from the data via a linear minus operator. Remaining noise spikes were removed by implementing an impulse noise removal operator, as well as a transient noise removal operator for the 70 kHz data, which was particularly noisy. Once the noise spikes were removed, a background noise removal algorithm was applied with a maximum noise threshold of -125 dB and a minimum SNR of 10, as described in De Robertis & Higginbottom (2007). A final 3x3 median filter (5x5 for the 70 kHz data) was applied to remove any remaining background noise sources. Before removing noise for each wideband frequency, the data were converted to base Sv using a type conversion operator, so that the background noise removal algorithms could be applied.

In some files, the above background noise removal process was unable to remove certain sources of “bad data,” such as engine noise. In such cases, the noise was removed manually by defining regions of “bad data” that were then excluded from export.

The acoustic data were then binned into cells of 100 m horizontally and 5 m vertically for final exportation to .csv files.

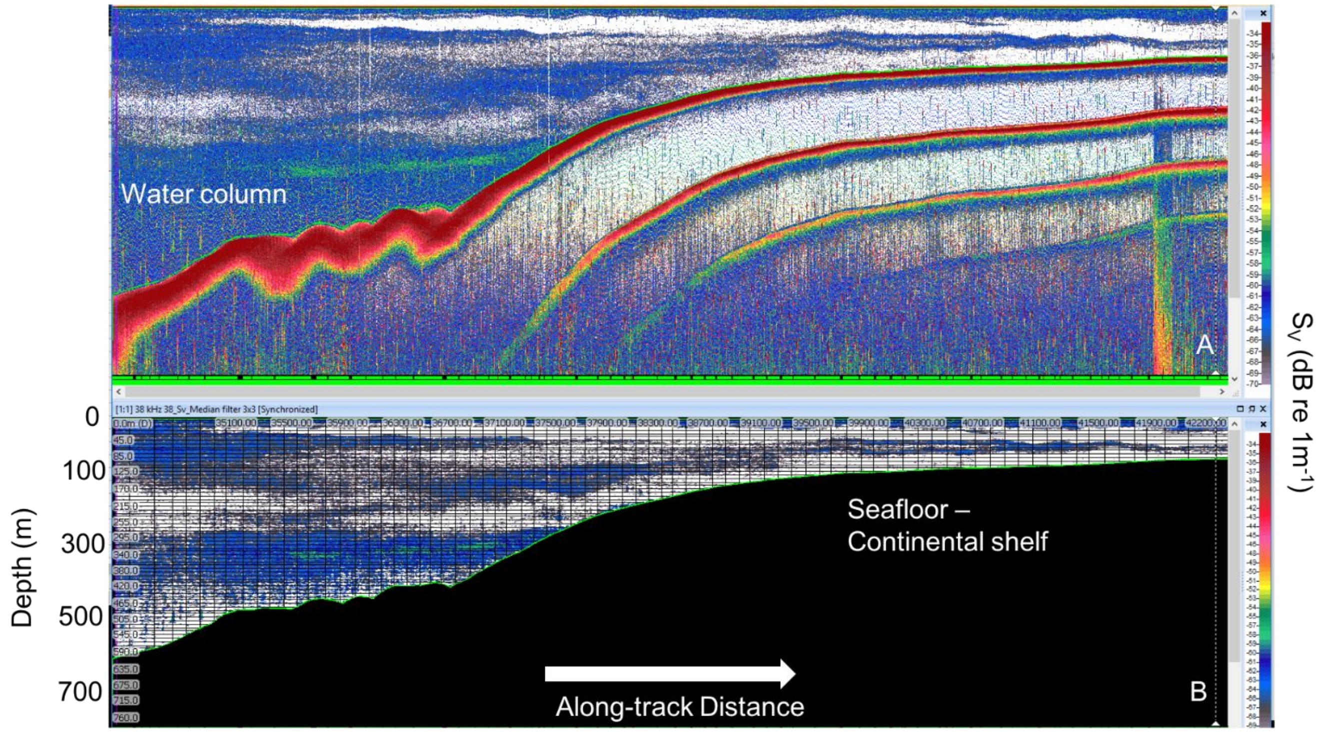

Figure 1. A38 kHz echogram of an FSAS transect at site VAC from the EN615 cruise. Panel A is before processing, panel B is after.

De Robertis, A. & Higginbottom, I., 2007. A post-processing technique to estimate the signal-to-noise ratio and remove echosounder background noise. *ICES Journal of Marine Science*, 64(6), pp.1282–1291.