Figure S1. Example of a CTD station without a well-defined mixed layer (blue category). a CTD profiles of temperature (blue) and salinity (red). b Reflection coefficient profile derived from CTD data (see methods section for details).
Figure S2. Example of a CTD station where the ΔT threshold method fails (outlier marked as red cross in Fig 3). a CTD profiles of temperature (blue) and salinity (red). b reflection coefficient profile derived from CTD data (see methods section for details). Blue horizontal line show MLD\textsubscript{CTD} derived from the ΔT threshold method.

Figure S3. a MLD\textsubscript{CTD} (blue dots) and MLD\textsubscript{EK80} (black dots), mean values (solid lines) and plus/minus one standard deviation (dashed lines) for the AO2016 stations without ΔT modification. b difference between MLD\textsubscript{EK80} and MLD\textsubscript{CTD}. c example of a CTD profile with temperature (blue) and salinity (red). d reflection coefficient profile derived from CTD data. Dark blue horizontal line show MLD\textsubscript{CTD} derived from the modified ΔT threshold and light blue from the non-modified ΔT threshold. Note that the rmsd between MLD\textsubscript{EK80} and MLD\textsubscript{CTD} using the non-modified ΔT is 58 m (compared to 3 when using the modified ΔT).
Figure S4. MLD detection failure due to loss of acoustic data close to the transducer. 

**a**, EK80 echogram.  
**b**, CTD profiles showing temperature (blue) and salinity (red).  
**c**, reflection coefficients derived from CTD data.  
**d**, heave (black), speed over ground (blue).

Figure S5. MLD detection failure due to noise from unknown source. 

**a**, EK80 echogram.  
**b**, CTD profiles showing temperature (blue) and salinity (red).  
**c**, reflection coefficients derived from CTD data.  
**d**, heave (black), speed over ground (blue).