Text S1. Supplementary methods:

We applied a method similar to the one described in Bianchi & Mislan (2016) to obtain migration speeds of the two deepest scattering layers (termed L2 and L3; Fig. S1) during diel vertical migration (DVM) of mesopelagic fishes in the Red Sea. We used daily gridded (0.5 m depth and 90 s time intervals) echograms representing volume backscatter (S_v, dB re 1 m^{-1}) for this analysis. In order to facilitate layer detection, we first interpolated these data to a temporal resolution of 30 s and removed short (<10 min) data gaps. Then, we smoothed the data by convolution (2.5 m and 7.5 min window).

Our aim was to represent the fastest part of the DVM of L2 and L3 below the epipelagic layer. Therefore, we restricted the following analyses to the periods between the beginning of nautical twilight and ca. 50 min after sunrise (representing the morning migration), and between ca. 50 min before sunset and the end of nautical twilight (representing the afternoon migration), respectively. Furthermore, we subset the data to depths between 200 and 500 m. See Fig. S1 for an illustration.

For each subset, we then detected the core depths (i.e. maximum backscatter) of the scattering layers. We did this by first determining the depths of local backscatter maxima (minimum peak height –70 dB, minimum peak prominence 3 dB, maximum 5 peaks) at each time interval using the *findpeaks* function contained in the MATLAB Signal processing toolbox (Mathworks). We then combined these time-depth locations of backscatter peaks into layers: We constructed an empty matrix with columns for each time interval and rows subsequently being filled by the layer depths. To fill the matrix, we looped over the individual time intervals. If one or more backscatter peaks were found in the respective time interval, we assigned those peaks to the row where the average layer depth of the five previous time intervals was closest to the depth of the current time interval. If no previous depths existed or the depth difference between all previous depths and the current peak depth was larger than 50 m, the backscatter peak was assigned to a new row.

Finally, we fit least-squares splines to the core depths of each detected scattering layer (Fig. S1), using the MATLAB Shape Language Modeling toolbox (D'Errico 2022). We only accepted layers that moved over more than a 50 m depth interval. For L2 and L3, we calculated the average migration speed within their shallowest 50 m of detection (Fig. S1). This means that in a case where, e.g., L3 was detected between 240 m and 500 m, the speed would be calculated from the 240 m to 290 m depth interval.

LITERATURE CITED

Bianchi D, Mislan K (2016) Global patterns of diel vertical migration times and velocities from acoustic data. Limnol Oceanogr 61: 353–364

D'Errico J (2022) SLM - Shape Language Modeling (https://www.mathworks.com/matlab central/fileexchange/24443-slm-shape-language-modeling), MATLAB Central File Exchange. Retrieved 24 February 2022.

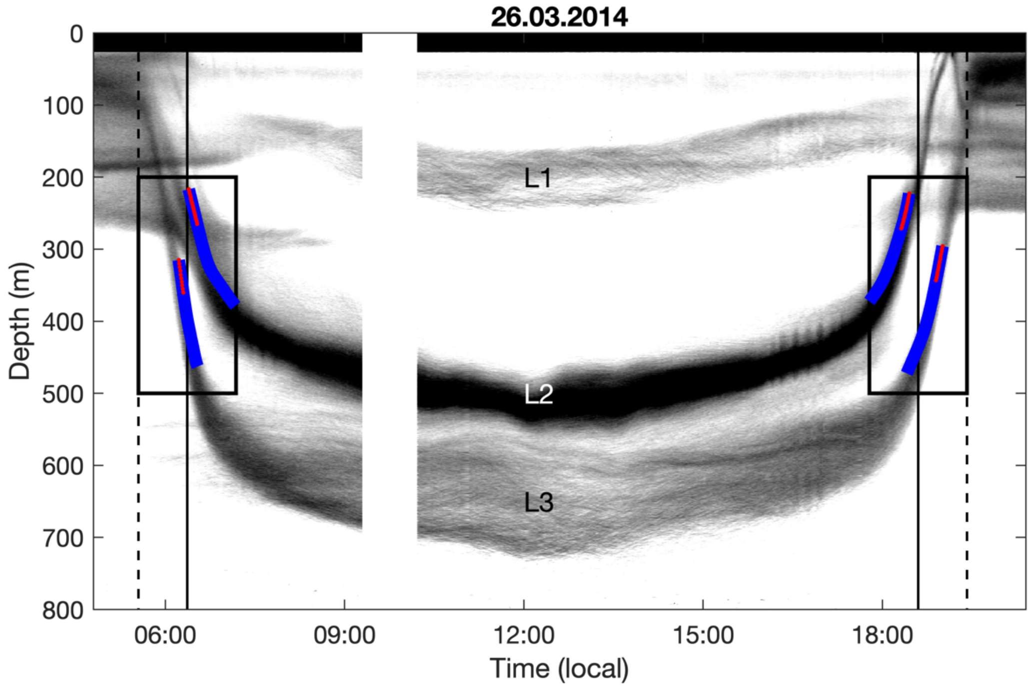

Fig. S1. Example illustrating assessments of migration speed. The vertical, black lines indicate sunrise and sunset, the dashed lines the beginning and end of nautical twilight. The black rectangles indicate parts of the echogram used for the determination of migration speeds of L2 and L3. The thick, blue lines show the fit of the detected scattering layers. The thinner, red lines indicate the upper 50 m of the detected layers, that were used for speed calculations.