Marine mammal vocalizations off Cape Hatteras are correlated to the Gulf Stream position

GROUP A
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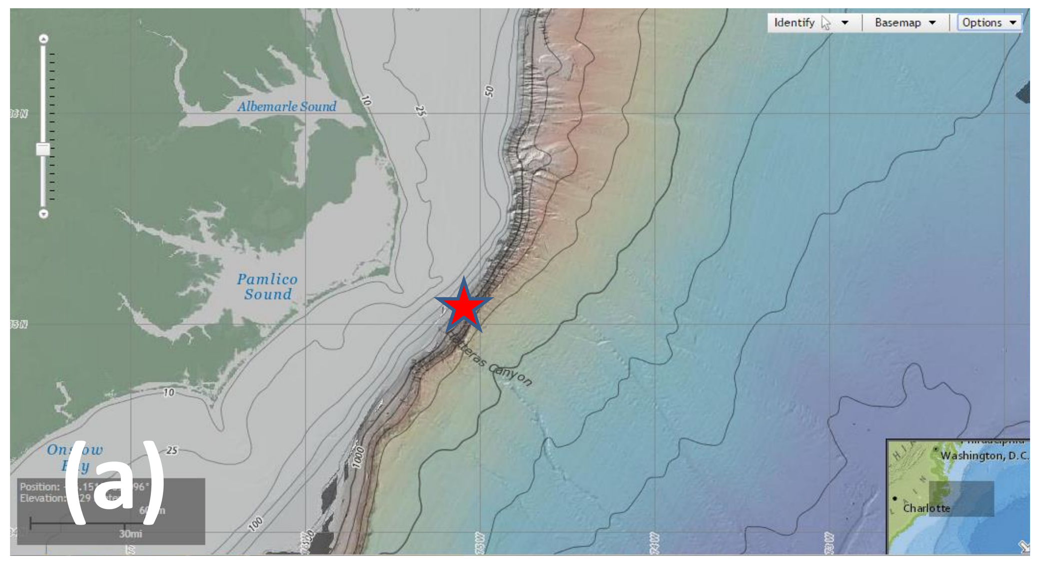
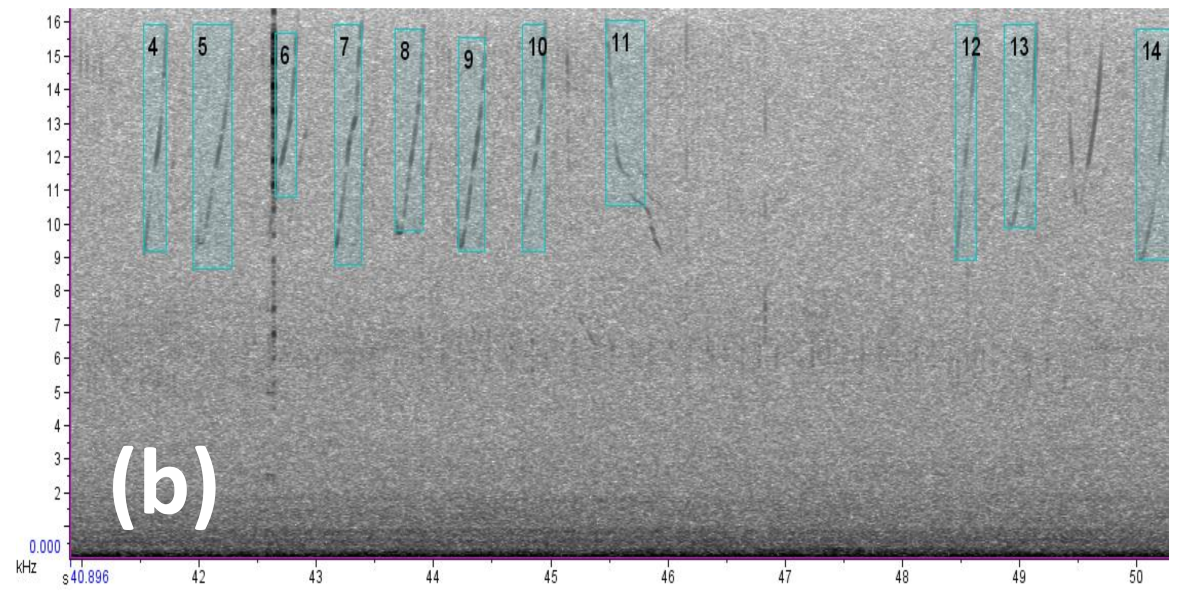
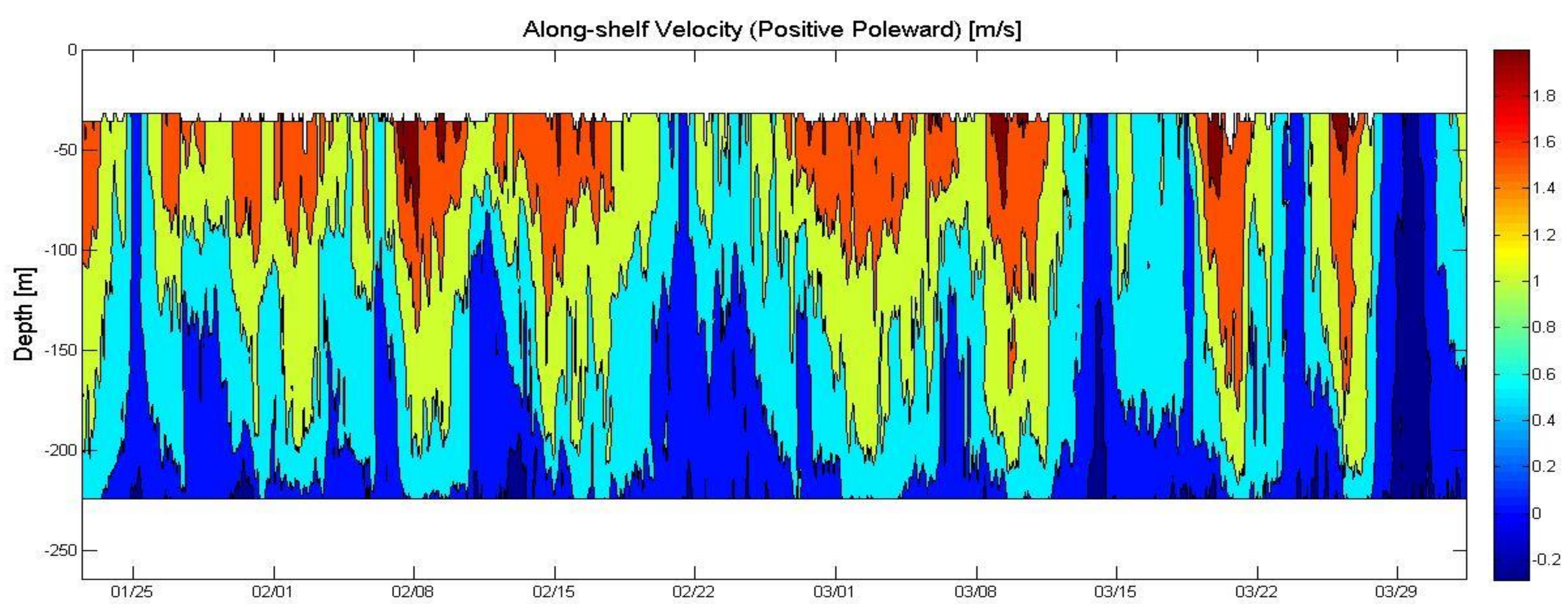


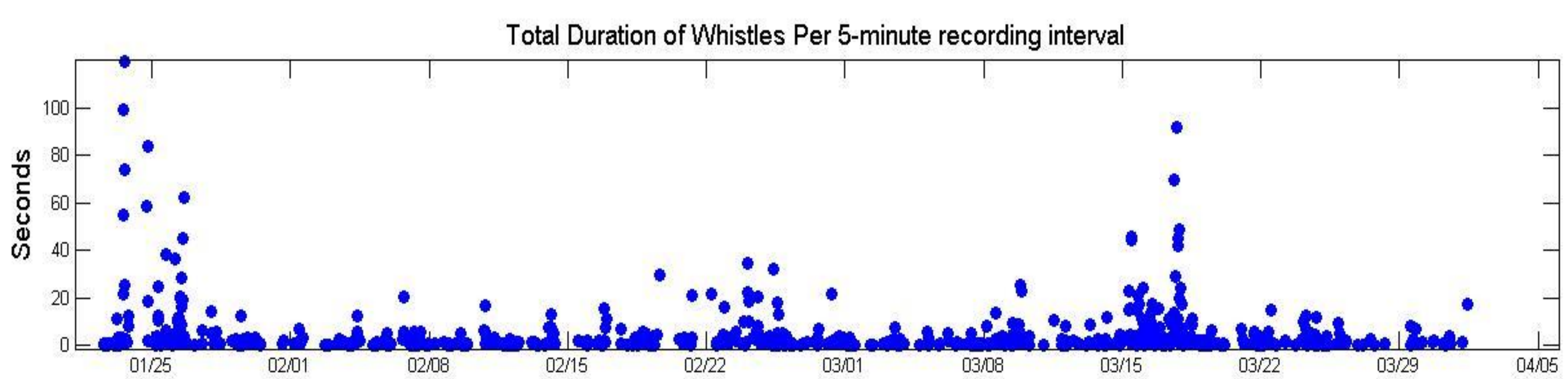


We deployed a hydrophone on the continental slope off Cape Hatteras, North Carolina, USA **(a)** from late January 2015 to late April 2016, on a mooring at a depth of 230m. The Aural-M2 hydrophone was configured to sample at 32,768 samples/second, recording for 5 minutes out of every half-hour. For each recording interval, we detected whistles **(b)** using Silbido with a SNR threshold of 10dB. For each 5-minute recording interval, we measured the total duration (in seconds) of whistles.

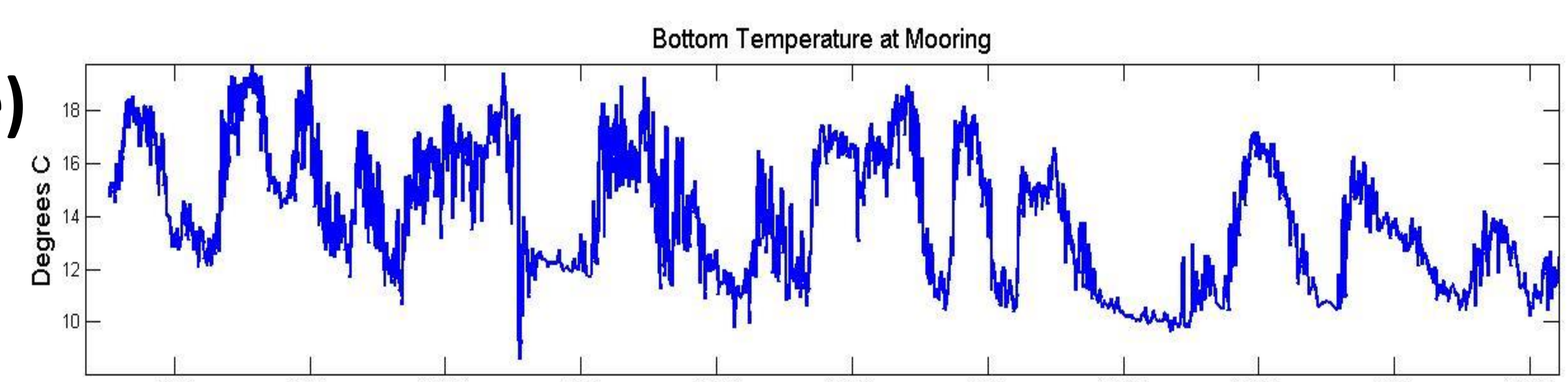
(c)



(d)

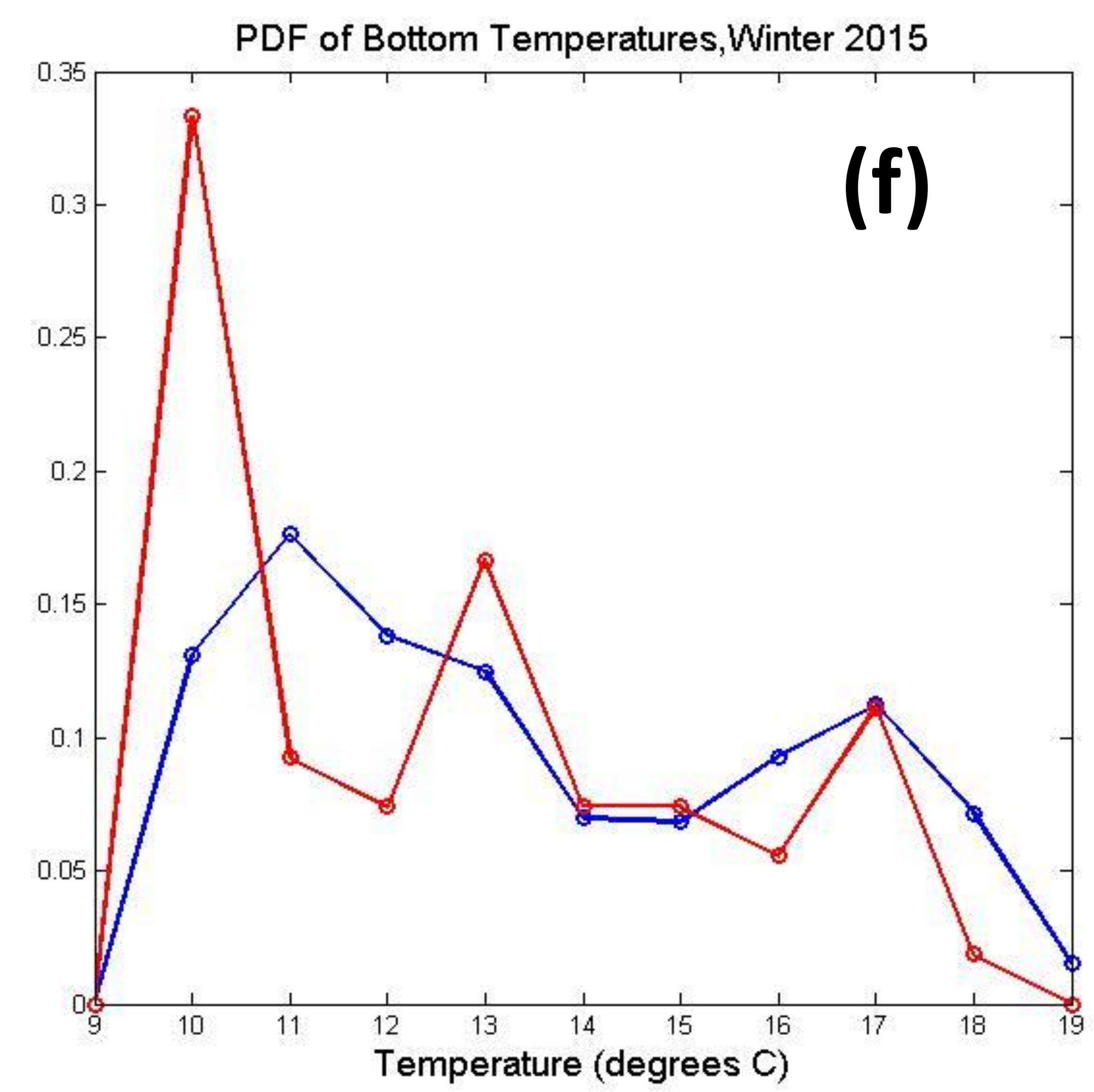


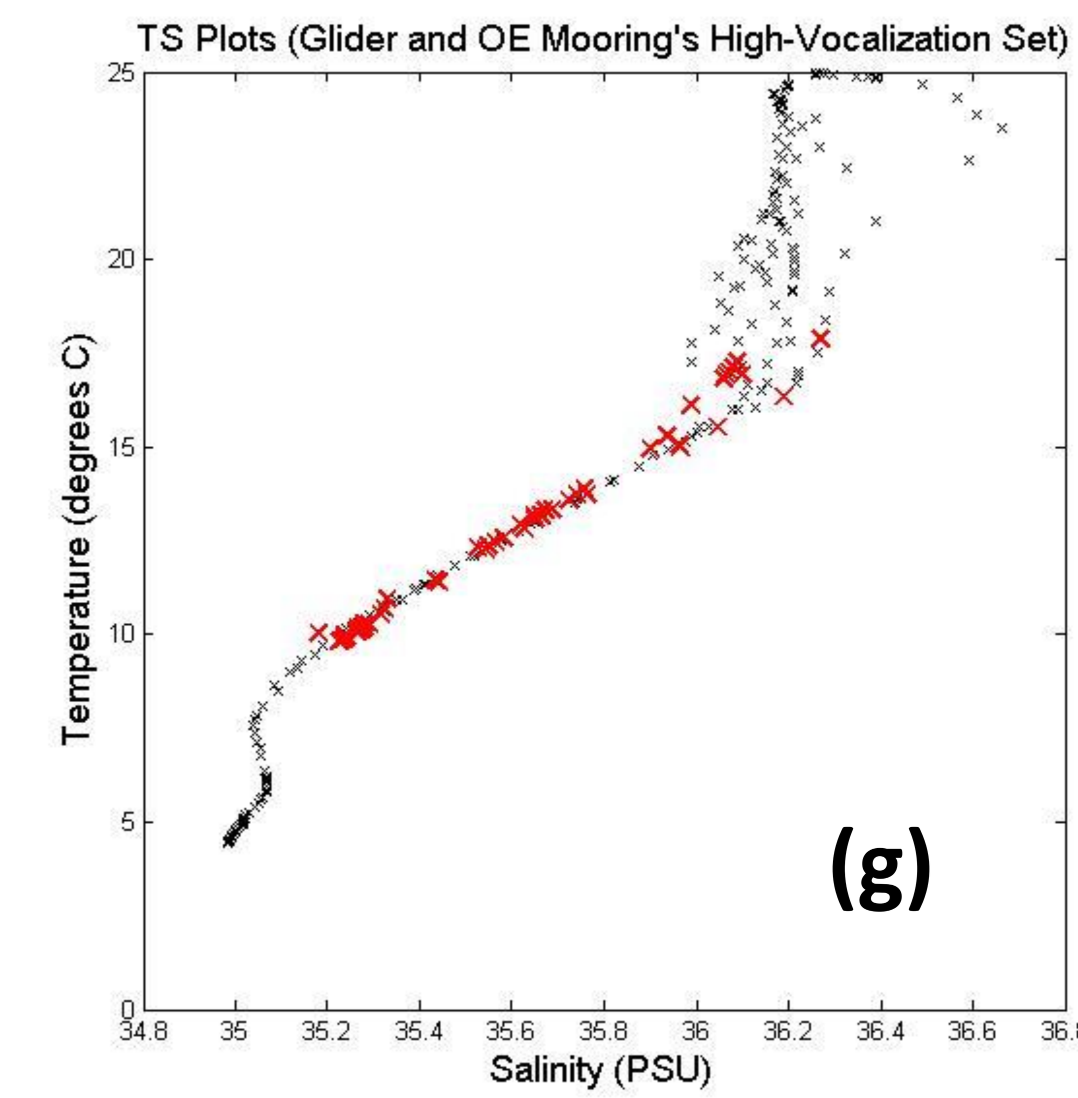
(e)



The mooring also included oceanographic instruments—a CTD and an Acoustic Doppler Current Profiler (ADCP). Above, we zoom in from late January 2015 to early April 2015. From the mooring's ADCP, **(c)** shows the along-shelf velocity of the current above the mooring as a function of depth (y-axis) and time (x-axis). From the vertical structure of the velocity field, we can tell whether the Gulf Stream is above the mooring or farther offshore. From the mooring's hydrophone, **(d)** plots the total duration (in seconds) of detected whistles for each 5-minute recording interval. From the mooring's CTD, **(e)** shows the temperature on the bottom.

For bottom temperature, we defined two subsets: a "**high vocalization**" subset (with its PDF in **red** in **(f)**) consisting of the temperature samples that were acquired when there was *more than* 15 seconds of whistling in the 5-minute recording interval, and a "**low vocalization**" subset (with its PDF in **blue** in **(f)**) consisting of the temperature samples acquired when there was *less than* 15 seconds of whistling in the 5-minute recording interval. To test our hypothesis that the two subsets are statistically different, we used the Kolmogorov-Smirnoff test. This test was performed per season. **The KS test indicates that these subsets are statistically different in both winters.**





When the Gulf Stream meanders offshore, there is upwelling of cooler, nutrient-rich water into the meander trough, as depicted in **(h)**. To characterize the water mass that *we* measured, we show a scatter plot of temperature and salinity in **(g)**, where the **red** points are from the "**high vocalization**" subset (for the winter of 2015), and the **black** points comprise the more complete TS curve of the Gulf Stream in this area.

Therefore, these data suggest that the cooler, fresher water that we sense when there is a lot of whistling is indeed this nutrient-rich water mass upwelling into the meander trough.

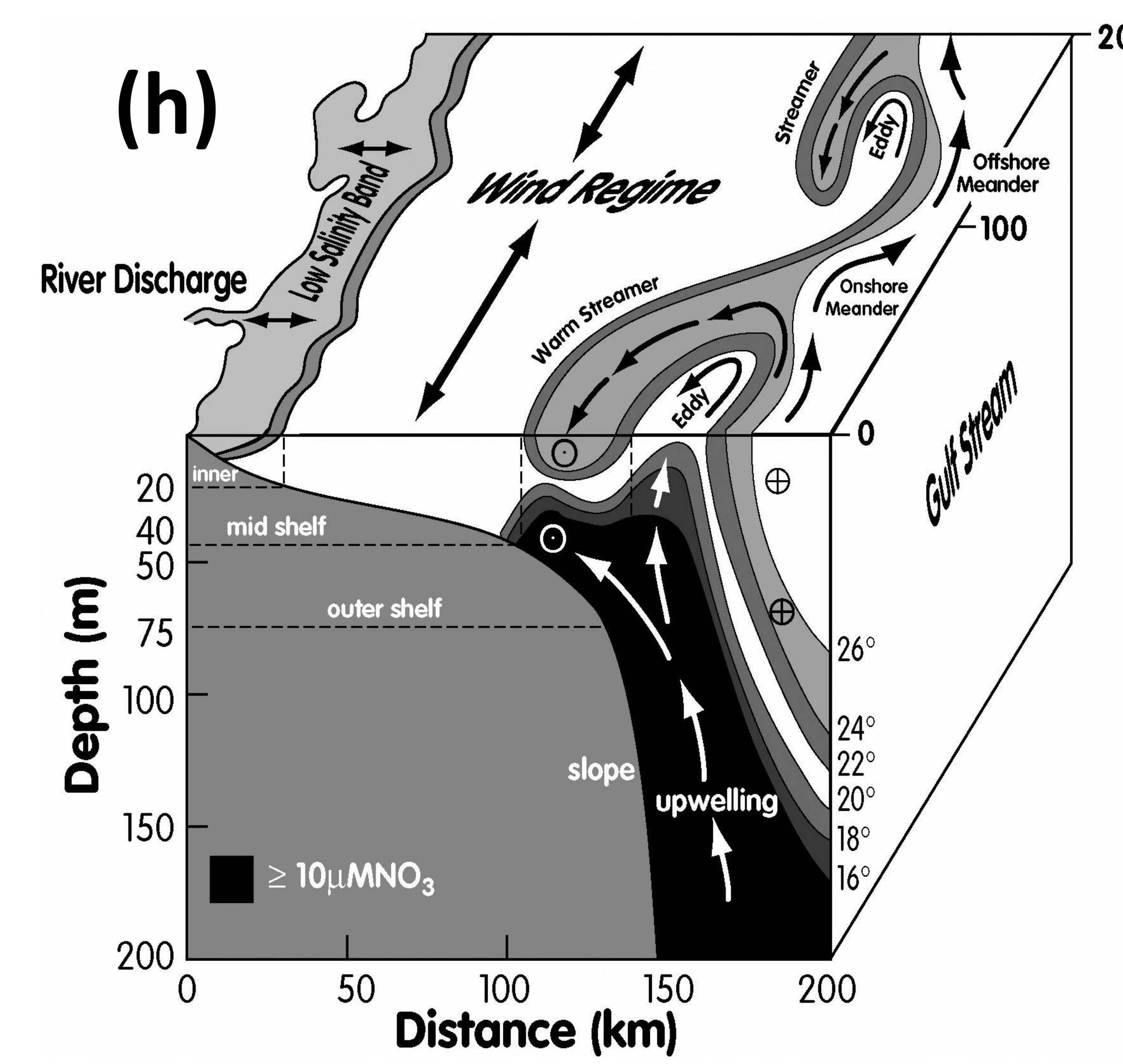


Figure from Jahnke and Blanton, 2010

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REFERENCES:
Jahnke, RA and JO Blanton. The Gulf Stream. Chaper 3 in Carbon and Nutrient Fluxes in Continental Margins, Springer, 2010.