Reply to the interactive comments made by anonymous referee #2 on "Marine mammal tracks from two-hydrophone acoustic recordings made with a glider" by Elizabeth T. Küsel et al.

Referee # 2:
This manuscript is worthwhile publishing only because the use of acoustics on glider for marine mammal detection is in its infancy and it's important to share various investigators' experiences and results from their field test. In this case, 23 hours of recordings were achieved but most of the data occurred in a 1-hour time span.

Authors' response:
After receiving the two anonymous reviews to our manuscript, it became clear to us that the objectives of our work should be more explicitly stated. The main objective was to evaluate the glider data for population density estimation studies, which require all of the components mentioned by both reviewers, such as localization and detection. It was not our intention for the paper to address any singular component, but to present a comprehensive report about all factors. For clarification, we have modified the text to reflect this, and have properly identified all components.

To clarify the data set and the portion we chose to present: because our intention was to demonstrate the type of analyses that could be done with the data and not describe the data in its entirety, we chose the period with the best data. While almost 23 hours of recordings were made by the acoustic acquisition system on the glider, the specific 1.5-hour span was when most of the marine mammal activity was observed. This does not imply that there were no data on the remainder of the recordings.

Referee # 2:
However, I do have a number of misgivings about this manuscript and are basically involve the avoidance of serious discussion about the usefulness and accuracy of the results. I will details some of the items that the authors should address in a revision.

1. The accuracy of the bearing estimates is never discuss and I think it needs to since I believe the accuracy was not very high. The baseline is too short and the further out the animals are from the glider the more inaccurate the estimate. Also the position of the animals with respect to the glider direction will have a big effect on the accuracy. The dynamics of the glider, especially the yaw, is not even mentioned. The localization is discussed in a manner that suggest no problems, not issues, perfect localization. I think this issue is considerably more important than the techniques used for localization since time of arrival difference based cross correlation analysis is fairly routine.

Authors' response:
The reviewer's comments are well founded and are being addressed in the revised manuscript. With regards to accuracy, a more detailed analysis is being added to the bearing estimation section. The accuracy of the estimate depends on a few things. One channel is used to detect clicks. A small time window around each detection is cross-

correlated with the same time window corresponding to the other channel. Cross-correlation gives an estimate of time difference of arrival. So, one can talk about accuracy of the detector, and accuracy of the cross-correlation algorithm. Accuracy can also be thought of as how well one can distinguish two closely vocalizing animals. It also depends on the minimum signal-to-noise ratio between call and background noise levels necessary for the cross-correlation to return a reliable estimate.

The further a vocalizing animal is from the hydrophones, the less likely it will be detected. The environment also plays a big role in how a sound will travel from source to the receivers. Navigation, spatial location and environmental data collected by the glider, as well as propagation modeling results are also being added to the manuscript to provide more insight into detections made and the tracking results obtained.

Referee # 2:
2. There is some hand waving in the statement "Such information can be valuable to density estimation methods, either directly for estimating the percentage of time a species produces sound during one day (Marques et al., 2013)." If you have a moving platform and come across a group of animals also moving, directly estimating the percentage of time a species produce sounds can surely be done but what does it mean? How such (bearing estimate) information be valuable to density estimation methods seems like a good statement to make but is it really true with poor bearing accuracy?

Authors' response:
The more information available, the better the density estimates since there are more covariates added to the analysis. A more detailed explanation of how the data from two sensors can be used to improve density estimates is given with references. It should be noted that some aspects of the methodology, like deriving the detection function for a glider, is a current research topic, which we also wish to address in the future.

Referee # 2:
3. There should be a better way of displaying click signals then a spectrogram. All you see is a line going to very high frequency (off the chart in some cases) and that's support to tell me more than the time of occurence? How's about plotting center frequency or peak frequency instead?

Authors' response:
Spectrograms continue to be the preferred tool used by many marine bio-acousticians, to show snippets of data or detections of marine animal sounds. Spectrgorams give not only the time of occurrence but also the frequency content of the call (vertical axis) as well as its energy content (color bar, usually in dB). If a sound's bandwidth (or frequency range) is bigger than half the sampling frequency of the instrument then they will appear clipped in the spectrogram (or off the chart). In our case, we cannot detect sounds that are above 48 kHz. However, figures are being added to the manuscript to better present the types of sounds we detected in our data, both biological and electronic.

Referee # 2:
4. A minor issue is the phrase in the last line of page 3, ": : :.where high frequencies are highly attenuated." I don't know what highly attenuated means? At 30 kHz the

absorption coefficient is about 3.9 dB/km and at 15 kHz its about 1.0 dB/km. I don't consider the 2.9 dB/km difference very large in the broader scheme of ocean propagation.

Authors' response:
According to the frequency dependent attenuation formula given by Jensen *et al.* (page 35, equation 1.34 on the first edition), at 30 kHz the attenuation is 8.3032 dB/km and at 15 kHz the attenuation is 2.4693 dB/km. The difference is 5.8 dB/km. In terms of a broadband sound this difference could mean that only the lower frequency components are detected.

Referee # 1:
5. I don't understand why click ID software such as M3R is not used to try to ID some of the deep diving odontocetes like beaked whales, Risso's dolphins and pilot whales.

Authors' response:
The three species mentioned by the reviewer, beaked whales, pilot whales and Risso's dolphins have click center frequencies reported to be over 40 kHz and bandwidths over 20 kHz. Our recording system offered a sampling frequency of 96 kHz, which is not enough to record the whole spectrum of those species' clicks. On the other hand, Sperm whales have clicks with lower frequency content, which we can be sure to record.