

Comparison of Morgan's discrete stereotyped call repertoire with a recent catalogue of Norwegian killer whale calls

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Executive summary

This study aimed to compare the acoustic repertoire of stranded killer whale “Morgan”, rehabilitated by the Harderwijk Dolfinarium, to a recent call type catalogue of wild Norwegian killer whales developed by Heike Vester. Acoustic recordings were made in Vestfjord between 2003 and 2009 and call types produced by known groups were compared to those produced by Morgan. We found good ‘likely’ matches to six and an additional five possible matches of calls recorded from Norwegian killer whale group P to the 21 stereotyped calls (including subtypes) in Morgan’s repertoire. Although most matches were found to group P, not all of Morgan’s calls matched calls in the catalog ascribed to group P. Group P is also reported to produce sounds which were not identified in Morgan’s repertoire. Thus, we cannot conclude that group P is Morgan’s natal pod, but we do consider it likely that Morgan is either from group P or a group closely related to group P. Identification of Morgan’s natal pod using acoustic sharing is made difficult by our limited knowledge of vocal development in young killer whales, group-specific and context calling patterns in Norwegian killer whales, and how call repertoires might vary over time. We stress that the results presented here should be considered preliminary as more research efforts on the remaining recordings that have not been analyzed yet could result in further matches and help to identify Morgan’s natal pod.

Methods

The discrete stereotyped call repertoire of Morgan, previously described in Samarra et al. (2010) was compared with a catalogue of Norwegian killer whale calls developed by Heike Vester. Please note that the nomenclature for call types from Norwegian killer whales described here bears no relation to that used in other catalogues.

This catalogue included calls recorded in Vestfjord between 2003 and 2009 and included a total of 115 call types (including sub-call and call combination types) from 17 different groups. This complete dataset had not been previously compared to Morgan's repertoire, therefore could provide new information on acoustic matches between Morgan and other wild killer whale groups. Only call types produced by known groups were included in this comparison, as only these allow for Morgan's group to be identified.

Potential matches between wild killer whale sounds and Morgan's sounds were classified by two observers (HV and FS), based on visual and aural assessment. Both HV and FS can be considered experienced observers of killer whale calls. Although in some cases some call types from wild killer whales could have been produced by more than one group, only recordings with high enough quality for a comparison to be made without doubt were used here.

Results and discussion

In an earlier study it was possible to find five matches from 3 different groups to the 21 sub call types produced by Morgan (Samarra et al. 2010). In this study we found additional potential acoustic matches to seven of the nine call types produced by Morgan, two call types (M8 and M9) could not be found. In total we found eleven matches of the 21 call types and subtypes. Six of the matches were considered to be very similar matches, hereafter termed 'likely' matches. Five other calls matched, but not perfectly, calls in the catalogue, and are hereafter termed 'possible' matches. However, more calls were found from group P and other groups that sounded similar but could not be completely matched to the call types of Morgan, due to the varying quality of the recordings (background noise or low sound pressure) and often calls themselves varied in structure and components, such as M5. Here we only report likely and possible matches.

The previous study (Samarra et al., 2010) also found a possible match between call M7i and call N100 described in Shapiro (2008), and recorded from an unknown group of killer whales feeding in Vestfjord in 2006. All remaining matches found in that study were again seen here. Neither of the studies found a match to calls M8 and M9. A list of the spectrograms of matches found in this study is provided below.

Likely matches

Call type M1 was considered a likely match to call N10 recorded from group P in Tysfjord in 2005 (Figure 1).

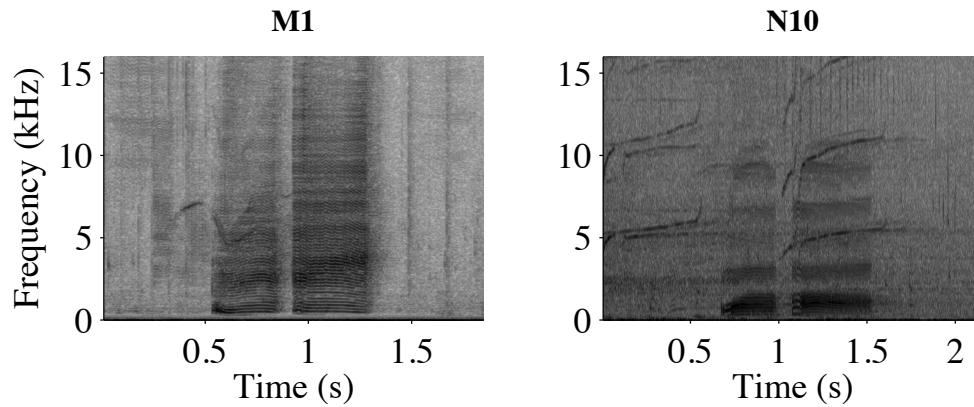


Figure 1. Likely match of Morgan's call M1 to call N10 recorded in 2005 from Norwegian group P.

Call type M2 (subtype i) was considered a likely match to the combination of calls N46+N47 also recorded from group P in Tysfjord in 2005 (Figure 2).

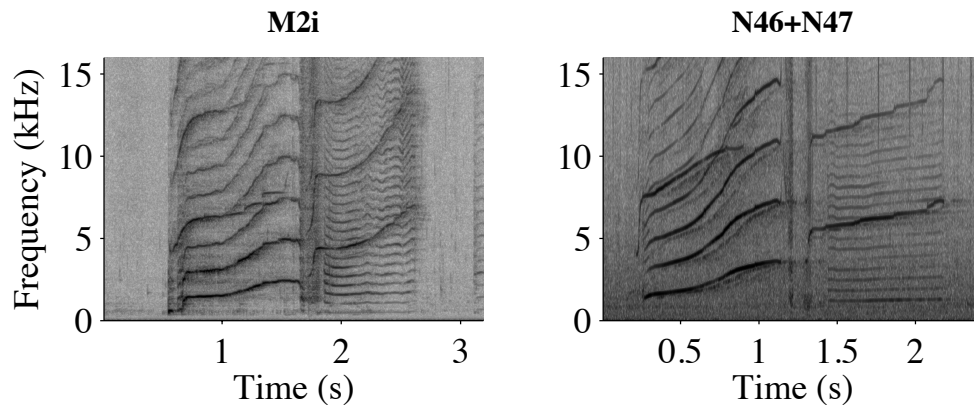


Figure 2. Likely match of Morgan's call M2i to the combination of calls N46+N47 recorded in 2005 from Norwegian group P.

Call type M2 (subtype ii) was considered a likely match to the combination of calls N46+N4i also recorded from group P in Tysfjord in 2005 and group BI+AA in 2007 (Figure 3).

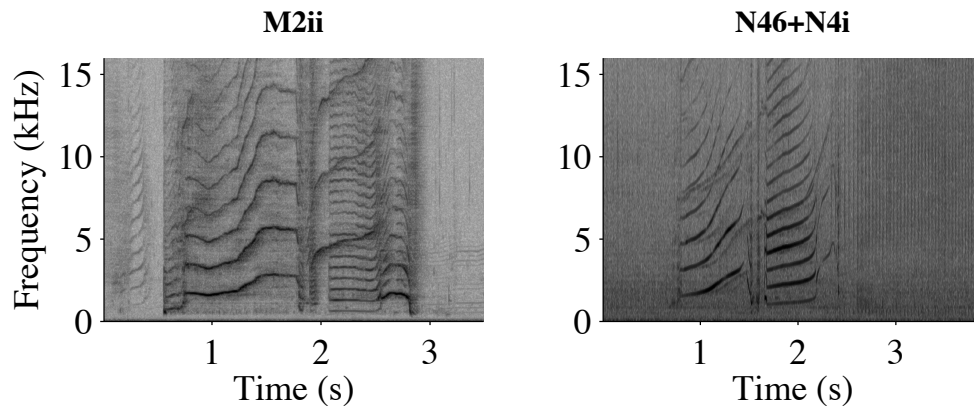


Figure 3. Likely match of Morgan's call M2ii to the combination of calls N46+N4i recorded in 2005 from Norwegian group P and in 2007 from group BI+AA.

Call type M2 (subtype iv) was considered a likely match to the combination of calls N39iii+N47 recorded from group P in Tysfjord in 2005 (Figure 4).

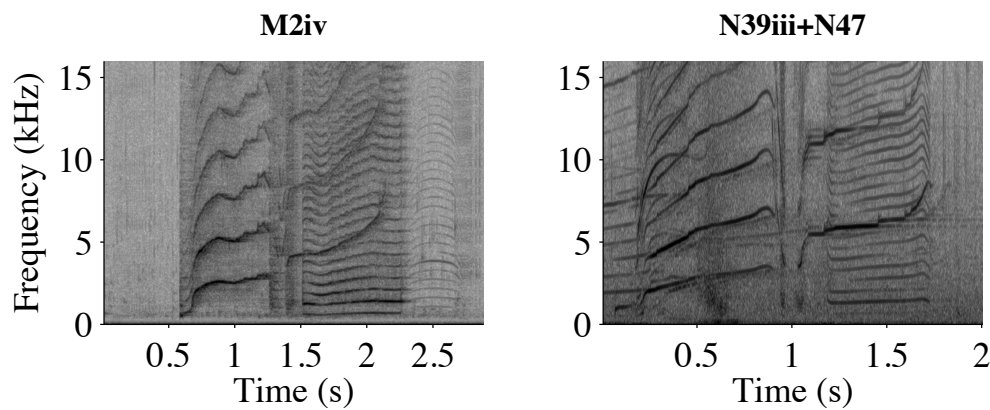


Figure 4. Likely match of Morgan's call M2iv to the combination of calls N39iii+N47 recorded in 2005 from Norwegian group P.

Call type M3 was considered a likely match to call N47i recorded from group P in Tysfjord in 2005 (Figure 5).

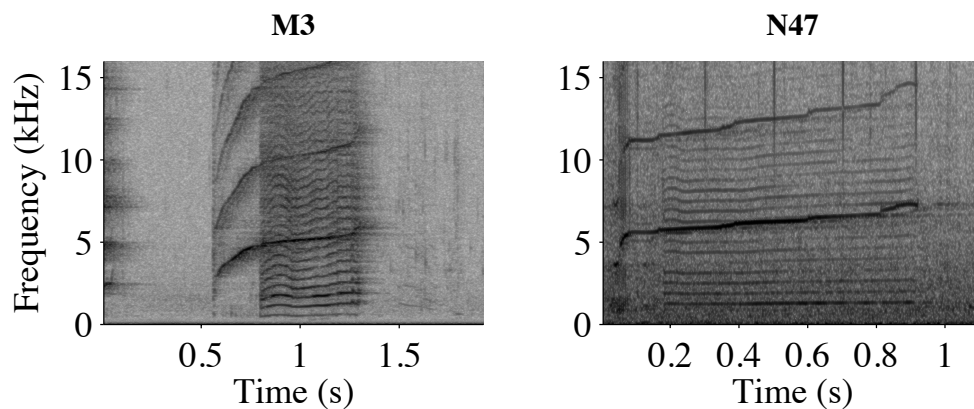


Figure 5. Likely match of Morgan's call M3 to call N47i recorded from group P in Tysfjord in 2005.

Call type M7ii was considered a likely match to call N4ii recorded from group P in Tysfjord in 2005 and groups BI and AA in 2007 (Figure 6).

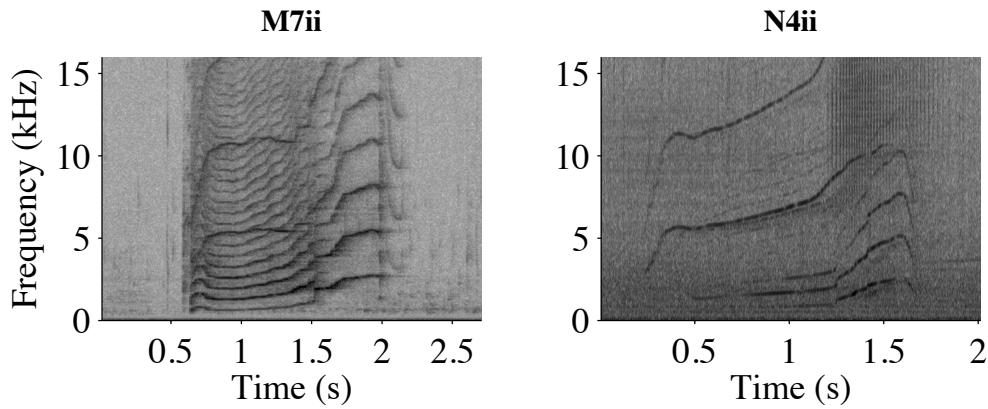


Figure 6. Likely match of Morgan's call M7ii to call N4ii recorded from group P in Tysfjord in 2005 and groups BI and AA in 2007.

Possible matches

Call type M4 was considered a possible match to call type N46, recorded from group P in Tysfjord in 2005 (Figure 7).

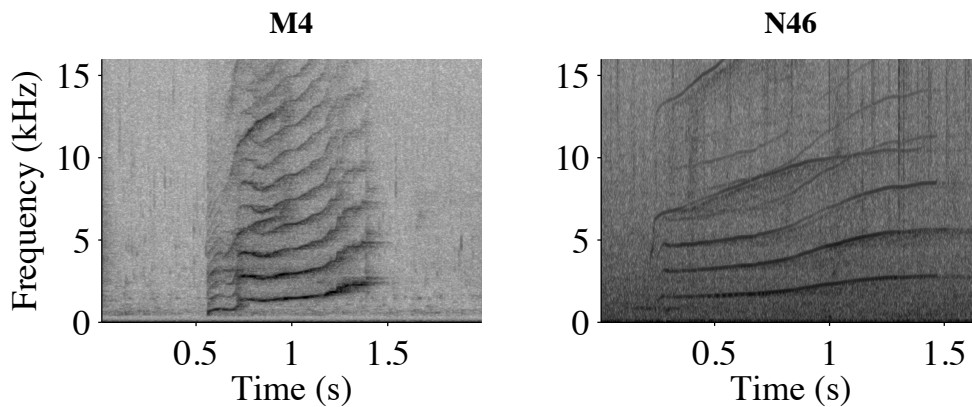


Figure 7. Possible match of Morgan's call M4 to call N46 recorded from group P in 2005.

Call type M5 (subtype iii) was considered a possible match to call N15ii recorded from group P in 2005 (Figure 8).

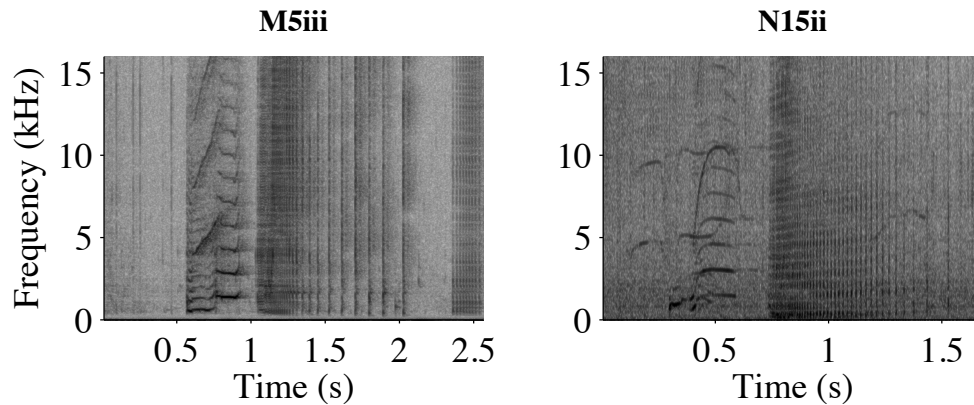


Figure 8. Possible match of Morgan's call M5iii to call N15ii recorded from group P in 2005.

Call type M5 (subtype iv) was considered a possible match to call N15iii recorded from group P in Tysfjord in 2005 (Figure 9).

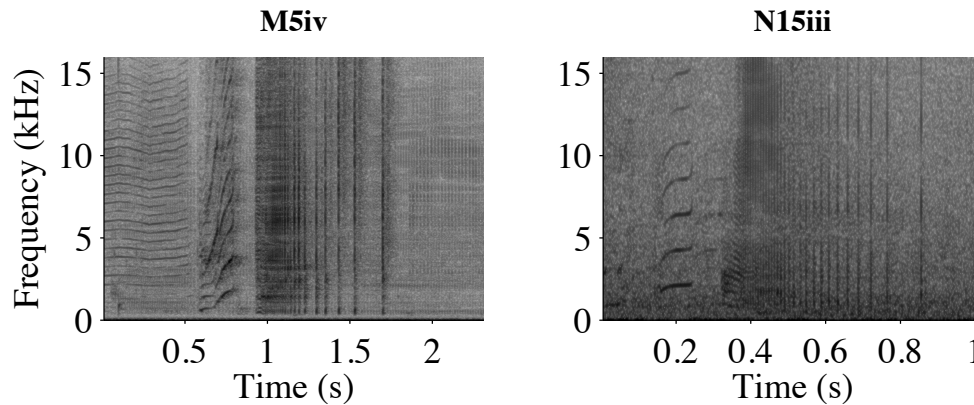


Figure 9. Possible match of Morgan's call M5iv to call N15iii recorded from group P in 2005.

Call type M6 (subtype ii) was considered a possible match to call N6 recorded from group P in Tysfjord in 2005 and group AM recorded in 2009 (Figure 10).

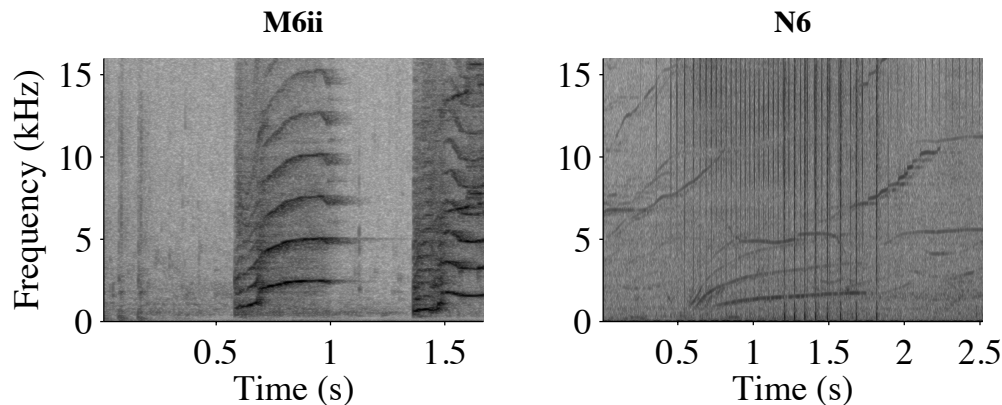


Figure 10. Possible match of Morgan's call M6ii to call N6 recorded from group P in 2005 and group AM in 2009.

Call type M6 (subtype iii) was considered a possible match to call N20 recorded from group P in Tysfjord in 2005 (Figure 11).

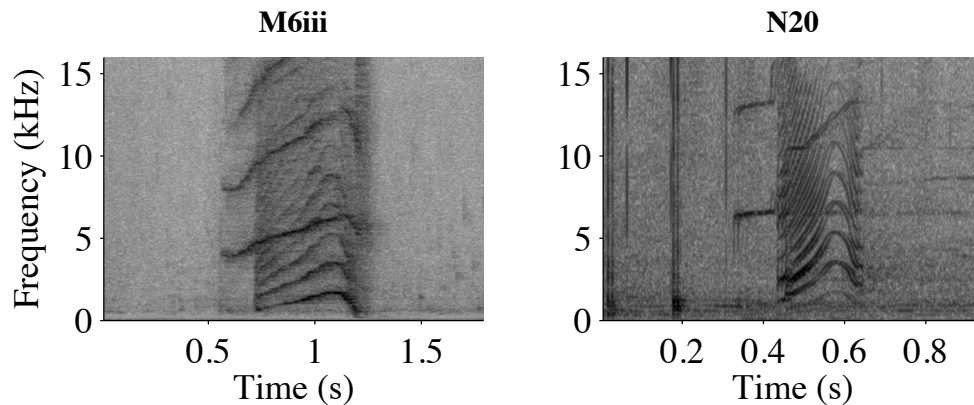


Figure 11. Possible match of Morgan's call M6iii to call N20 recorded from group P in 2005.

The similarity of Morgan's call types to calls recorded from group P suggests that Morgan could be from this group. Group P was seen in Tysfjord in 2004 and 2005 and consisted of 10-12 individuals. Group P has not yet been identified to match any existing photographed killer whale groups from the Norwegian catalogue developed by Tiu Similä and Sanna Kuningas. Group P was recorded on 19th November 2005 for 56 minutes during carousel feeding and socializing. From this recording 31 call types and several variable call types and whistles could be identified.

Conclusions

Our increased effort to look for acoustic matches between Morgan's sounds and calls of known killer whale groups using additional data collected in northern Norway, to try and find Morgan's natal group, resulted in a close match to one group and some matches to other groups of Norwegian killer whales. This supports the previous findings that Morgan originates from the herring feeding population of killer whales occurring in northern Norway.

Our results show that most of Morgan's sounds can be matched to known Norwegian killer whale groups, although much data remains to be analyzed. While the majority of matches of call types were found in group P, we cannot at this stage conclude this to be Morgan's natal group because part of her repertoire did not match calls from this group. Morgan did not produce the whole vocal repertoire of group P and two call types from Morgan (M8 and M9) could not be found in the vocal repertoire of group P.

However, there are several factors that make such acoustic comparisons difficult. The short recoding time (56 min) and limited context (carousel feeding and socializing) of the recording from group P may increase the chance that not the entire repertoire was recorded from this group P. In addition, Morgan may not match their repertoire given the different context (alone in captivity) and the young age (vocalization is not fully developed). There is a possibility that, given her young age, Morgan has not fully developed her repertoire yet. Very little is known of killer whale vocal development, but it has been shown that by 1 year of age a young killer whale can produce some of the stereotyped calls produced by the mother, but still has other undeveloped sounds in its repertoire (Bowles et al., 1988). Assuming Morgan was approximately 1 ½ to 2 years old when admitted (Van Elk, 2010), her acoustic repertoire might not have been fully developed, which could confound the attempts to match her sounds to a wild group. In addition, collecting high quality recordings and photographs of wild killer whales and analyzing to allow for identification of individuals and acoustic comparisons is not only difficult as a lengthy process, limiting the data available and the conclusions that can be made from a short comparison such as this. Since several calls are also shared with other groups, some of which were in close proximity to group P, it is plausible that Morgan could originate from a less known related pod that has a similar acoustic repertoire to that of group P, but for which a full repertoire description is not yet available.

Given the urgency of the analysis it was not possible to include the vast amount of recordings that had not been processed and classified yet. For example, not all of Morgan's sounds have been analysed yet, as mentioned in the previous report. More than 20 hours of data were collected by H.Vester in 2011 and more than 40 hours of recordings are owned by Dag Vongraven from Mid-Norway, Tysfjord, Ofotfjord and Vestfjord collected between 1987 and 1997. Recent acoustic and photographic data has also been collected off Andenes, which has not been analysed yet. In order for complete comparisons with all data to be carried out, a significant longer period (on the order of months) would be required to analyse recordings that still need processing.

In addition, recordings of killer whale groups expected to come close to the shore of northern Norway outside Andenes within the next months (November - January), as occurred last winter, and inside the Vestfjord from May-September, could result in further matches being found. Further analysis of sounds produced by Morgan and wild

killer whales could lead to identification of more stereotyped sounds and help to identify Morgan's natal pod.

Acknowledgments

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References

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