Morgan's Extended Family has been Identified Acoustically.

Prepared by the Free Morgan Foundation

(30 September 2011)

EXECUTIVE SUMMARY

- 92% of the calls made by Morgan were matched to a Norwegian orca group.
- 77.7% of Morgan's call types (seven of nine) were matched to P pod.
- Only one hour of recordings of P pod were used to match these 77.7% call types.
- Not all members of P pod have been photographically identified, therefore it is not possible to ascertain if they have been present or not in Norwegian waters.
- 57% of Morgan's call types (four of nine) were matched to NP pod (with AA+BI).
- Only 0.3% of call-types were *not* matched to either NP or P pod.
- At least seven additional groups were matched to at least five call types.
- Morgan's acoustic repertoire may be limited because of her confinement in a concrete barren tank and due to her young age.
- There are only extremely limited field research projects being currently conducted on Norwegian orca and further research is clearly needed.
- It is possible that the two 'non-matched' calls are 'contact' or 'distress' calls. Such calls would not necessarily be recorded from orca which are safely in the context of their social groups.
- Play-back of Morgan's calls to wild orca, or wild orca calls to Morgan, has not been conducted and may provide additional information and call-types.

EXECUTIVE RECOMMENDATIONS

1. The Free Morgan Foundation strongly recommends that Morgan's rehabilitation in Norwegian waters begins immediately.

2. Concurrently, her contemporary vocal repertoire can be recorded, as well as further recordings of wild orca in Norwegian waters can be carried out, to allow refined searches to be made for Morgan's natal group (including analyzing further databases).

3. It is imperative that further delays are prevented and that the welfare of Morgan is addressed by allowing her to return to her family.

On the 23rd of September 2011 the second acoustic report regarding attempts to match Morgan the orca acoustic repertoire reported a 77.7% match to P group, with matches to an additional 10 other groups in Norwegian waters. This was despite an extremely limited database, very tight constraints and an incomplete repertoire of both Morgan and the wild orca population.

On the same day (at 16:56 hours) the *Dolfinarium Harderwijk*, via their lawyer, submitted an email to the Ministry for Agriculture and Foreign Trade, stating the following (translated from Dutch);

"P-pod is not sufficiently enough indentified (No clear pictures and the pictures don't match available catalogs). P pod was spotted in 2005 for the last time. Even if Morgan is related to this pod, this match is not useful because this pod can't be found."

We, the members of the Free Morgan Foundation, wish to clearly state that this is a manipulation of the data. It is clear that the *Dolfinarium Harderwijk* has deliberately excluded pertinent data to attempt to influence the outcome of the Ministry's decision regarding Morgan's release. Given that matches have been made to 77.7% of her call-types and despite the limitations of the research (see details below), such a finding is a clear indication that her Morgan's extended family has been identified. Further investigations whilst Morgan undergoes rehabilitation in Norway will help to refine which individuals she is likely to rejoin and to locate those already identified as part of her family.

The alternative to releasing Morgan into the wild is enforced cohabitation with non-family members, in a permanent captive situation. This is unacceptable under any circumstances, but more so when her extended family has been identified, despite the restrictions of limited databases (a matching effort which was confined to very tight constraints and partial call repertoires for both the wild orca and Morgan).

We reiterate here that is NOT imperative that Morgan's natal group is identified, but rather just her extended family. Social acceptance by such members has been demonstrated in orca society, both inside the fission-fusion type of structures found in Norwegian waters as well as in the more rigid social structures found in the Pacific Northwest.

We clarify our stand with the following points;

(1). **It is incorrect to state that P pod has not been sighted since 2005, as all the individuals are not identified, therefore it is not possible to document their presence**.

The very fact that P pod has not been completely documented, through either photographic identification or through acoustic recordings, means that by default it cannot be ascertained if P pod has in fact been sighted (or not) since 2005.

Given the relatively small research effort by independent researchers in the waters of Norway, it is entirely likely that P group has in fact returned to the area since 2005, but despite this return it has not been either photographically, or acoustically, recorded.

This is also clearly evident when considering that many orca in the Norwegian waters have yet to be photographed or matched to any catalogues. Catalogues are disjointed and in many cases are not updated. To illustrate this point, Heike Vester in a pers. comm. (dated 26 September 2011), sent to Dr Visser of the Free Morgan Foundation, stated the following; "*Sanna Kunningas* [a previous orca researcher] *went through my* [orca] *pictures and compared them and found a few matches, but not many. However in group AA (my naming) Sanna found a member of the NP group, so it is likely that the matches I found from BI+AA are actually from NP, which again would fit with the matches Filipa* [Samarra] *found*."

If BI and AA pods are in fact the same as NP pod, then the number of acoustic matches to NP pod would increase from three to four call-type matches. NP pod was most recently sighted in 2009 (and NO groups of orca were sighted by the Samarra et al research group in 2010 due to poor weather conditions, however orca groups were sighted during 2010 and 2011 by whale watching companies). AA + BI pods may be sub-pods of NP pod but further research, in the field, is clearly needed.

It is also important to note that the Samarra et al (2010) report clearly stated that more research was required to gather field recordings and identify individual orca in Norwegian waters. Despite this recommendation, the *Dolfinarium Harderwijk* has not at any time (since the release of the Samarra et al report on the 5th of November 2010) implemented any field research. Nor have they, as far as we are aware, requested photos of NP pod to be circulated to look for sightings of this group, since Morgan's extended family was acoustically identified nearly a year ago.

Furthermore, the Vester and Samarra (2011) report concludes with the following statement (page 8) "*Further analysis of sounds produced by Morgan could lead to identification of more stereotyped calls in her repertoire. The catalogues of sounds from the North Atlantic were of highly variable quality and age, so updated complete catalogues of North Atlantic killer whale calls would be helpful. Finally, acoustic surveys of killer whales in the North Atlantic have not entirely covered all North Atlantic populations, and surveys even within the better-studied*

Norwegian population are also likely to be incomplete. Thus, more fieldwork aimed at recording sounds from identified groups of killer whales in the North Atlantic could help to identify Morgan's natal pod."

(2). **Photo-identification is a method with inherent biases, therefore it is not possible to always confirm the presence of any one individual or a group of individuals.**

Photo-identification is a method that utilizes photographs to record congenital and acquired identification marks. For orca, every individual can be uniquely identified from high-quality photographs (Baird, 2000). The dorsal fin is the main feature that is photographed because it is exposed above water more often than other areas (Bigg, 1982). However, orca can also be photo-identified by their distinctive saddle patches (Bigg, 1982, Baird and Stacey, 1988), eye patches (Visser and Mäkeläinen, 2000, Mäkeläinen, 1999), pigmentation patterns on the underside of the tail (Visser, 2000), malformations (Berghan and Visser, 2000, Stenersen and Similä, 2004), scars from propellers (Visser, 1999, Visser and Fertl, 2000) and body scars such as teeth rake marks (Visser, 2000, Visser, 1998, Baird, 2000). However, it is common practice when studying wild orca populations to consider that not all individuals present during any one encounter are actually photographed. *Inter alia*, the limitations of photo-identification include field research scope (including spatial and temporal restrictions), quality of images, differences avoidance / approach behaviours to vessels, temporal or permanent shift in home range, present but not encountered, encountered but not photographed, not identifiable in the photograph (e.g., photographed when travelling away from the vessel). Additionally, individuals may acquire new marks which can obscure or remove previous identification marks. Furthermore individuals change over time and missed-matches as well as mis-matches may occur.

In certain study areas around the world, some individual orca have not been resighted for up to 10 years, whereas others are seen numerous times each year (e.g., (Visser, 2000, Baird, 2000, Ford and Ellis, 1999, Ford et al., 1994). As orca can live in the wild for up to 80 years (Bigg, 1982), the potential is high for all of the possibilities outlined above to feature in the resighting history of any individual or group of individuals.

As such, photo-identification results when used for association indices, are adjusted to account for such known biases. These include the bias where the number of mutual sightings is likely to be underestimated. There are two reasons why this might happen: firstly, before two individuals can be scored as sighted together, both must be seen and photographed; secondly, when two individuals are separate this can be recorded if either of the two individuals is photographed, whereas only one individual can provide association data when they are together (Cairns and Schwager, 1987). As such a half-weighted index is commonly used (e.g.,

spinner dolphins (*Stenella longirostris*) (Östman, 1994), bottlenose dolphins (*Tursiops truncatus*) (Bräger et al., 1994), Hector's dolphin (*Cephalorhynchus hectori*) (Bejder and Dawson, 1997) and orca (Visser, 2000, Heimlich-Boran, 1986).

(3). **The recording used to acoustically match Morgan's vocal repertoire to P pod was based on only one hour of recordings of P pod and recordings were of poor quality.**

Vester & Samarra (2011) noted on page 8, that "*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*."

Vester & Samarra (2011) on page 2, noted that
"*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*."

Additionally, the Samarra et al (2010) report states that although only three call types were matched to NP pod that "*However, it is also possible that pod NP's repertoire has changed somewhat since the report by Strager (1993).*" (page 7). It should also be noted that pod BI and AA are possibly sub-pods or closely related to NP pod (see pers. comm. Vester, in section 1).

Furthermore, Samarra et al (2010) also stated the following: "*It is plausible that Morgan could originate from a less known related pod that has a similar acoustic repertoire to that of NP pod, but for which a full repertoire description is not yet available*." (page 7).

(4). **The full acoustic repertoire of Morgan has not necessarily been collected and may be modified due to her captive situation.**

Samarra et al (2010) state the following on page 4; "*Most call types and subtypes were identified after the analysis of 300 calls but it took more than 700 calls for all types to be identified. This suggests that Morgan might be producing sound types at different times and so our selected sample could still be missing a few of Morgan's types.*"

Vester & Samarra (2011) further stated on page 8, "*However, there are several factors that make such acoustic comparisons difficult. ..... Morgan may not match their repertoire given the different context (alone in captivity) and the young age (vocalization is not fully developed)*."

Yet, despite these two recommendations and the recommendation and repeated requests of the Free Morgan Foundation for contemporary matching and recordings, the *Dolfinarium Harderwijk* has refused to allow more recent recordings of Morgan's calls to be made. Therefore it cannot be established if new calls can be identified, if her repertoire has changed,

or if her repertoire as used in the Samarra et al (2010) and the Vester & Samarra (2011) reports are complete.

(5). **It has been established that there are movements of some individuals between groups of orca within Norwegian waters.**

As previously submitted by the Free Morgan Foundation, it has been illustrated through various sources that there are movements between some individual groups of orca within Norwegian waters. Therefore, again, the limited identification of some individuals of P pod (as well as the incomplete identification of all individuals in the group / subgroups) indicates that part of Morgan's extended family may have been present in Norwegian waters since 2005, but not documented.

It is clear that further photographic analysis of orca, in association with clear acoustic recordings needs to be complied. Until this is complete it is impossible to state that any particular group (or part of a group) was present or not.

(6). **Only a restricted analysis was conducted on the acoustic repertoires of Norwegian orca.**

Vester and Samarra (2011) did not have sufficient research time to analyze substantial sections of uncatalogued calls made by Norwegian orca. At least two full seasons of data have yet to be digitized (Vester and Samarra (2011)) and a further full season of digitized data was not compared to Morgan's call repertoire.

This is especially poignant given that *only* "likely" and "possible" matches are included in the results presented by both the Samarra et al (2010) and Vester and Samarra (2011) report. Additionally, it should be noted that attempts to match Morgan's calls were *only* made to calls of known groups (*i.e.,* there remains unanalyzed data from unknown orca groups and orca groups which are yet to be catalogued).

(7). **Morgan's calls M8 & M9 were not matched to any call types.**

Call types M8 (0.1% of calls) and M9 (0.2% of calls) were not matched to any call types produced by Norwegian orca. Given that not all available recordings were analyzed, further research may result in matches. However, it is also entirely possible that these two call types are 'contact' request calls – produced by an animal which is searching for its social group. Such calls can be likened to a human call for 'help' or calling out of 'hello?'. Additionally, it cannot be excluded that these two call-types are distress calls.

Regardless of if they are 'contact' or 'distress' call, as such they may not be normally produced by a social group of orca which is foraging or socializing as 'contact' is already established and they are unlikely to be in a stressful situation. Therefore it is unlikely that such calls would be

recorded in this type of behavioural setting (i.e., the behavioural state of P pod when recorded by Vester was foraging and socializing).

Furthermore, the *Dolfinarium Harderwijk* has refused to allow recent recordings of Morgan to be made, to establish if her call repertoire has changed, or the frequency of certain call types has altered. It may be possible to conduct 'play-back' of Morgan's calls to pods of wild orca in Norwegian waters to record responses.

(8). **Morgan has been established to be between 3-5 years at capture, based on her size. Her extended family was recorded in Norwegian waters around the time of her birth.**

As per the data presented to the Ministry for Agriculture and Foreign Trade on the 9th September 2011, in Den Hague, Morgan's age can be estimated (when captured) at more than three years and possibly as much as five years. An extract of that data is presented here:

Table 1. Extract from Data regarding Morgan's age at capture, presented to the Ministry for Agriculture and Foreign Trade, on 9th September 2011, Netherlands.

LOCATION	SEX	AGE YEARS	LENGTH (cm) + (other details)	SOURCE
PACIFIC	F	3	335	(Myrick et al., 1988)
NORTH ATLANTIC	F	?	350 (MORGAN capture June 2010)	Dolfinarium Harderwijk
NORTH ATLANTIC	M	3	350	(Myrick et al., 1988)
NORTH ATLANTIC		3.3-3.9	350 (calculated from Clark (3.50 - 2.32) / 0.36 = 3.3 years and her maximum age would be (3.50 - 2.32) / 0.30 = 3.9 years	(Clark et al., 2000)
NORTH ATLANTIC	F	5	350	(Duffield and Miller, 1988)

This size/age estimate would indicate therefore that Morgan was born between June 2005 and June 2007. The most recent acoustic recording of P pod in the Vester and Samarra (2011) report is 2005. The last sighting of NP pod in the Samarra et al (2010) report was 2009. Therefore both dates of the most recent recordings fall within the timeframe for Morgan's estimated birth date. Given that no call-types of Morgan's were matched to orca outside of Norwegian waters, she was likely to have been born in that area (i.e., she does not appear to have learnt calls from orca outside of Norwegian waters). This corroborates the spatial distribution of Morgan's extended family's home-range (i.e., Norwegian waters).

(9). **Past lack of evidence of presence does not preclude future presence.**

Norwegian waters (see Samarra et al (2010) and Vester & Samarra (2011) for details of recording locations). Given the predisposition of orca to return to productive areas for foraging (e.g., see Ford et al., 1994, Baird, 1994, Baird, 2000, Ford and Ellis, 1999) and the recent return of herring (prey) to Norwegian waters (Vester pers. comm.), it is highly likely that if certain groups have not been present recently that they are likely to return to Norwegian waters.

Of note is that there have been NO matches to Morgan's repertoire to other acoustic catalogues (i.e., Iceland, Shetland).

(10). **Morgan has been acoustically matched to a number of different groups.**

Therefore, it would be a misrepresentation of the facts to insinuate that Morgan's extended family was comprised solely of members of P pod. The report commissioned by the *Dolfinarium Harderwijk* (Samarra et al, 2010) states (page 1; "*we do consider it likely that Morgan is from a group closely related to pod NP*".).

Visser (2011) submitted a summary report to the to the Ministry for Agriculture and Foreign Trade and published this summary on the website www.freemorgan.org. This report presented a table outlining the calls matched to each of the groups in the two reports.
For clarification the following Table is repeated here;

Table 2. Summary of Morgan's call types and the Norwegian orca groups they were matched to. A total of seven of the nine call types were matched (77.7%). (Source: Visser, 2011, RE: Previous and Recent Acoustic Matches to Vocal Repertoire of Morgan the Orca.).

Morgan's call (+ subtype)	Norwegian Orca Group*
M1	NP; P
M2 (i) M2 (ii) M2 (iv)	NP; BI+AA; P
M3	NA; NÅ; NG; P
M4	P
M5 (iii) M5 (iv)	NP; NT; NK; P
M6 (ii) M6 (iii)	AM; P
M7 (i) M7(ii)	BI; AA; P Unknown (herring-feeding)

* Note: A photographic match has been made between BI+AA group to NP group, indicating that these groups may be either related, subgroups of NP group or close associates of NP group (see point 1).

(11) **All call types with more than 1 % frequency have been matched.**

All call types for which 1% or more calls were produced were matched. Excluding the 'variable' call types (7% of calls, see Samarra et al (2010) for details), this is 92% of the calls made by Morgan. This also represents seven of the nine call-types (77.7%) which have been matched (see Table 3, data extracted from Samarra et al 2010 and data from Table 2, above). Only two call-types (M8 (**0.1%** of calls) and M9 (**0.2%**) of calls) were not matched. Therefore only 0.3% of call-types were not matched to either NP or P pod.

Table 3. Percentage of occurrence of different call types

Call type	% of total calls (number of calls)	GROUP MATCHED *
M1	5% (70)	NP; P
M2	**22%** (290)	NP; BI+AA; P
M3	1% (18)	NA; NÅ; NG; P
M4	2% (20)	P
M5	1% (11)	NP; NT; NK; P
M6	**58%** (759)	AM; P
M7	3% (36)	BI; AA; P, Unknown (herring-feeding)
M8	0.1% (2)	Not Matched
M9	0.2% (3)	Not Matched
TOTAL MATCHED	**92%**	At least eight (possibly 10) different orca groups match Morgan's calls

* Note: A photographic match has been made between BI+AA group to NP group, indicating that these groups may be either related, subgroups of NP group or close associates of NP group (see point 1).

Acknowledgments

Our thanks to Heike Vester, Filipa Samara, Dr Dag Vongraven and all those involved in attempting to match Morgan's calls. We appreciate their professionalism and assistance with this project.

REFERENCES

BAIRD, R. W. 1994. *Foraging behaviour and ecology of transient killer whales (Orcinus orca).* Ph.D. Dissertation, Simon Fraser University, Burnaby, British Columbia, Canada.

BAIRD, R. W. 2000. The killer whale. Foraging specializations and group hunting. *In:* MANN, J., CONNOR, R. C., TYACK, P. L. & WHITEHEAD, H. (eds.) *Cetacean Societies: Field studies of dolphins and whales.* Chicago: University of Chicago Press.

BAIRD, R. W. & STACEY, P. J. 1988. Variation in saddle patch pigmentation in populations of killer whales (*Orcinus orca*) from British Columbia, Alaska, and Washington State. *Canadian Journal of Zoology,* 66**,** 2582-2585.

BEJDER, L. & DAWSON, S. 1997. Ecology and behaviour of Hector's dolphin and tourism in Porpoise Bay. Department of Marine Science, University of Otago, PO Box 56, Dunedin, New Zealand.

BERGHAN, J. & VISSER, I. N. 2000. Vertebral column malformations in New Zealand delphinids with a review of cases world-wide. *Aquatic Mammals,* 26**,** 17-25.

BIGG, M. 1982. An assessment of killer whale (*Orcinus orca*) stocks off Vancouver Island, British Columbia. *Reports of the International Whaling Commission,* 32**,** 655-666.

BRÄGER, S., WÜRSIG, B., ACEVEDO, A. & HENNINGSEN, T. 1994. Association patterns of bottlenose dolphins (*Tursiops truncatus*) in Galverston Bay, Texas. *Journal of Mammalogy,* 75**,** 431-437.

CAIRNS, S. J. & SCHWAGER, S. J. 1987. A comparison of association indices. *Animal Behaviour,* 35**,** 1454-1469.

CLARK, S. T., ODELL, D. K. & LACINAK, C. T. 2000. Aspects of growth in captive killer whales (*Orcinus orca*). *Marine Mammal Science,* 16**,** 110-123.

DUFFIELD, D. A. & MILLER, K. W. 1988. Demographic features of killer whales in oceanaria in the United States and Canada, 1965-1987. *Rit Fiskideildar,* 11**,** 297-306.

FORD, J. K. B. & ELLIS, G. M. 1999. *Transients: Mammal-hunting killer whales,* Vancouver, University of British Columbia Press.

FORD, J. K. B., ELLIS, G. M. & BALCOMB, K. C. 1994. *Killer whales: The natural history and genealogy of Orcinus orca in British Columbia and Washington State,* Vancouver, University of British Columbia Press.

HEIMLICH-BORAN, S. L. 1986. Cohesive relationships among Puget Sound killer whales. *In:* KIRKEVOLD, B. C. & LOCKARD, J. S. (eds.) *Behavioral biology of killer whales.* New York: Alan R. Liss Inc.

MÄKELÄINEN, P. 1999. *Geographical variation in killer whale saddle patch and eye patch shape.* Masters, University of Helsinki.

MYRICK, A. C., YOCHEM, P. K. & CORNELL, L. H. 1988. Toward calibrating dentinal layers in captive killer whales by use of tetracycline layers. *Rit Fiskideildar,* 11**,** 285-296.

ÖSTMAN, J. S. O. 1994. *Social organization and social behaviour of Hawai'ian spinner dolphins (Stenella longirostris).* Ph.D. Dissertation, University of California.

SAMARRA, F. I. P., DUC, A.-V. & MILLER, P. J. O. 2010. Identification of Morgan's discrete stereotyped call repertoire and matching to soudns recorded from wild North Atlantic killer whales. St Andrews Fife, UK: Sea Mammal Research Unit, Scottish Oceans Institute, University of St Andrews.

STENERSEN, J. & SIMILÄ, T. 2004. *Norwegian killer whales*, Tringa forlag.

VESTER, H. & SAMARRA, F. I. P. 2011. Comparison of Morgan's discrete stereotyped call repertoire with a recent catalogue of Norwegian killer whale calls. Henningsvær, Norway: Ocean Sounds.

VISSER, I. N. 1998. Prolific body scars and collapsing dorsal fins on killer whales in New Zealand waters. *Aquatic Mammals,* 24**,** 71-81.

VISSER, I. N. 1999. Propeller scars and known migration of two orca (*Orcinus orca*) in New Zealand waters. *New Zealand Journal of Marine and Freshwater Research,* 33**,** 635-642.

VISSER, I. N. 2000. *Orca (Orcinus orca) in New Zealand waters.* Ph.D. Dissertation, University of Auckland.

VISSER, I. N. & FERTL, D. C. 2000. Stranding, resighting and boat strike of a killer whale (*Orcinus orca*) off New Zealand. *Aquatic Mammals,* 26**,** 232-240.

VISSER, I. N. & MÄKELÄINEN, P. 2000. Variation in eye-patch shape of killer whales (*Orcinus orca*) in New Zealand waters. *Marine Mammal Science,* 16**,** 459-469.