

# A note on guidelines for sustainable whale watching in Greenland

*With special focus on humpback whales*



A report developed for the Greenland Tourism and Business council (GTE) and Kommuneqarfik Sermersooq

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# A note on guidelines for sustainable whale watching in Greenland

With special focus on humpback whales

by

Tenna Kragh Boye, Malene Simon and Fernando Ugarte



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# 1. Eqikkaaneq

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- arfeq 500 meterisut ungasitsigisup iluaniitillusi sukaalligitsi (salleraaqarnaveersaarneq)
- arfeq tunuaniit sioraaniillu orninnaveersaarsiuk
- arfeq 50 meterisut qanitsigisumiitillugu mootori sarpissortinnasiuk unitsissiulluunniit

## 2. Sammenfatning

Hvalsafari er en stigende industri på verdensplan og ligeledes i Grønland. Intensiv hvalsafari i Nuup Kangerlua har en negativ effekt på hvalernes adfærd i form af øget svømmehastighed, forkortede dykketider samt et fald i antallet af gange hvalerne kom til overfladen. Dette kan medføre mindre tilgængelig tid til at søge føde i og et øget energiforbrug. Det vides ikke, hvorvidt disse kortvarige påvirkninger kan få mere langsigtede konsekvenser for hvalernes forplantningsevne ved f.eks. lavere fekunditet, et fald i kalvenes overlevelse eller om individuelle hvaler helt vil springe parringsæsonen over. Da både private og kommercielle hvalsafaribåde i Nuup Kangerlua ofte sejler ganske tæt pukkelhvalerne, var formålet med dette studie, at teste et sæt retningslinjer for hvalsafari i et forsøg på at minimere den negative effekt, som intensiv hvalsafari har på pukkelhvalernes adfærd.

Fra maj til september 2010 undersøgte vi i Nuup Kangerlua pukkelhvalers adfærd i relation til forskellige former for hvalsafari ved at observere hvalerne fra både. Observationerne blev inddelt i de tre kategorier *uforstyrret hval*, *retningslinjer overholdt* og *intensiv hvalsafari*. Herefter blev hvalernes blåstrater og dykkemønstre (antallet af gange en hval var i overfladen før den dykkede) sammenlignet på tværs af kategorierne. Tidligere observationer fra Nuup Kangerlua af blåstrater og dykkeradfærd fra 2006-2008 blev inkluderet i dataanalysen for at øge antallet af observationer, da pukkelhvalerne var svære at finde i 2010.

Resultaterne viste, at hvaler, som var under intensiv hvalsafari, havde tendens til en øget blåstrate og kom til overfladen færre gange inden dykning i forhold til hvalerne i de to andre kategorier. Datamængde var utilstrækkelig til definitivt at konkludere på de testede retningslinjer, men resultaterne indikerede, at brugen af retningslinjer, med stor sandsynlighed, kan minimere den negative indflydelse, som hvalsafaribåde kan have på hvalernes adfærd.

Baseret på disse foreløbige resultater anbefaler, vi at både private og kommercielle hvalsafaribåde følger nedenstående retningslinjer:

- sæt farten ned (ingen hækbølge) inden for 500 m af hvalen
- undgå at sejle mod hvalen direkte for- eller bagfra
- sejl ikke aktivt indenfor 50m af hvalen (sæt motoren i tomgang eller sluk den)

### 3. Summary

Whale watching is an increasing industry worldwide including Greenland. Unregulated whale watching in Nuup Kangerlua can have short term negative effect on humpback whale behaviour in terms of increased speed, fewer surfacings and abbreviated dives. These behavioural changes likely result in reduced time for foraging and increased energy consumption. It is not known to what extent these short term effects can accumulate to long term effects on various fitness parameters such as skipped breeding, lower fecundity and reduced calf survival. As humpback whales are often approached closely by both commercial and private whale watching boats in Nuup Kangerlua, the aim of the study was to test a set of whale watching guidelines to help whale watching become more sustainable.

From May to September 2010, the behaviour of humpback whales and whale watching boats in Nuup Kangerlua were recorded. Observations were then divided into three categories, according to the presence and behaviour of whale watching boats: *undisturbed* whale (i.e. no boats), boats following *guidelines* and *intensive* whale watching. The blow rate of humpback whales along with surfacing/dive ratio for each category were calculated.

Observations of blow rate and dive patterns collected in 2006-2008 were included in the data analyses to increase the sample size as humpback whales proved hard to find during 2010.

The results indicate that whales under the influence of intense whale watching tend to have a higher blow rate and a reduced number of surfacings before each dive compared to undisturbed whales and whales under the influence of whale watching boats following guidelines.

Although data was not sufficient to make conclusive statements the results suggest that the use of guidelines mitigate the effect of whale watching boats on whale behaviour.

Based on these preliminary results we recommend the following set of guidelines:

- slow down to “no wake” when within 500 m of the whale
- do not approach the whale directly from behind or in front
- do not actively move closer to the whale than 50 m



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## 4. Introduction

Whale watching is a growing industry worldwide (Hoyt, 2001), including Greenland. Humpback whales feed seasonally in Nuup Kangerlua from early May to late October and the whale watching boats are mainly targeting these whales. Around Nuuk, the commercial whale watching boats are limited to the fjord system where also traffic from private motor vessels is intense. The humpback whales within Nuup Kangerlua are therefore often approached closely by commercial and private whale watching boats.

Whale watching can have a short term negative effect on the behaviour of the humpback whales in terms of increased speed, fewer surfacings and abbreviated dives (Boye *et al.*, 2010). Boye *et al.* (2010) also showed that many of the individual whales had a high degree of small scale site fidelity, returning to Nuup Kangerlua year after year. The analysis of photo identification pictures indicated that only a limited number of whales enter the fjord during the entire feeding season. These results have been further supported by consecutive years of photo identification by the Greenland Institute of Natural Resources, where only 20-25 whales per year are photographed in the fjord. From 2007 to 2010, 52 humpback whales have been identified in Nuup Kangerlua, of which 29% have been photographed in the area during more than one year (Jensen and Rasch, *in prep.*). The combination of small scale site fidelity and relatively few individuals result in the same individuals being repeatedly approached by boats. It is unknown whether frequent disturbance will have an effect on the fitness of these individuals. The humpback whales come to Greenland to forage and restore the energy reserves needed for migration and reproduction. Repeated anthropogenic disturbance may result in an interruption of the normal foraging behaviour leading to a reduced food intake and a subsequent decrease in energy stores. Such a decrease could have an effect on various fitness parameters such as breeding, lower fecundity and reduced calf survival.

Watching humpback whales from boats is an activity valued by both tourists and locals. However, unregulated whale watching can disturb the animals and could even drive them away (Lusseau and Bejder, 2007), limiting their value as a resource. Guidelines for whale watching exist in a number of locations, but consist often of a long set of rules that are unpractical to follow and requires a high level of engagement by the boat drivers. Furthermore, whale watching guidelines have seldom been rigorously tested empirically. Our aim was to develop a set of guidelines that help whale watching become sustainable. We aimed at finding simple guidelines that could be remembered by private boat owners and professional whale safari operators alike without compromising the fitness of the

whales. This report presents an experimental study on the effects of whale watching guidelines on the whale behaviour. The results are discussed in the light of available literature including the results obtained by Boye et al. (2010) in Nuup Kangerlua. A set of guidelines are suggested for future navigation in the presence of humpback whales.

## 5. Developing guidelines

### 5.1 Outlining the guidelines

The outline and restrictiveness of guidelines concerning activities near wildlife are many and varies with the species and area in question, but the purpose of minimizing the impact on wildlife remains the same.

In Nuuk, whale watching is based primarily on humpback whales observed from motor boats (Fig. 5.1.1 and 5.1.2). There is a large number and variety in whale watching guidelines targeting large whales around the world (e.g. Carlson, 2009). Most of these guidelines incorporate a minimum distance to the whales observed. The minimum distance vary between countries, and often the type of boats and the number of boats during whale watching are taken into account. Engine status may be mentioned, but recommendations do not always join consensus. For instance, Argentina guidelines state that engines must be turned off closer than 100 m to the whales (Carlson, 2009) where the International Fund of Animal Welfare (IFAW) and Coral Reef Alliance recommend leaving the engine on but in idle, as whales have been known to collide with boats under sail (ICRAN, 2002). Other guidelines on whales in general incorporate how to approach the whales, a recommended time limit on whale watching, regulations on whale watching when a mother and calf are present or approaching animals at rest.

In Nuuk, there are around 15-20 tour operators who arrange whale watching trips. They organize a wide range of boat trips and do not simply rely on whale watching. However in the main season commercial whale watching boats set out daily looking for humpback whales on an opportunistic basis. Nevertheless, most whale watching is done not by the commercial whale watching boats, but by private boat owners who coincidentally spot a whale on their way between destinations. In 2010, Nuuk Boating Association counted 861 active boat members and boat owners who are not a member of the associations add on to this number. Hence, when designing a set of guidelines for the Nuuk area, several points must be taken into account:

- 1) Whale watching is based mainly on humpback whales observed from motorized boats (a negligible part by kayaks)

2) Most whale watching boats are private boats

3) At present Greenland has no regulations or laws concerning whale watching and therefore guidelines will be “standard for good practice”

To develop a set of guidelines relevant to Greenland we looked at the literature of guidelines already existing for other areas (e.g. Carlson, 2009) and adapted them to the Greenlandic requirements. Also, as no regulations are in force the guidelines must lean upon good judgment of the whale watchers and since whale watching is performed by many others than commercial whale watching operators, the guidelines must also address the hundreds of private boats. Hence, it is necessary that the guidelines depict a simple set of points which are easily followed and least restrictive without compromising the fitness of the whales. The guidelines tested during the field work in 2010 are listed in table 1.

**Table 1.** The guidelines tested during 2010 field work in Nuup Kangerlua

Within 500 m of the whale
Sail slowly (no wake) and avoid sudden changes in speed and direction
Avoid cutting off the whale’s swimming direction
Do not come closer than 50 m of the whale. In these instances go idle or turn engine off.



**Figure 5.1.1.** A commercial whale watching boat actively sails within 50m of a humpback whale and cuts off the whale's swimming direction. Photo: Greenland Institute of Natural Resources



**Figure 5.1.2.** A private whale watching boat sets off to reach a humpback whale before it dives. Photo: Tenna Boye

## 5.2 Methods in the field

Blow rate and surfacing patterns of cetaceans are good indicators of behavioural changes to whale watching vessels (Lusseau, 2003). From May to September 2010, boat based observations and a single land based observation of humpback whales were carried out (Fig. 5.2.1). The number of blows were continuously dictated to a VN 5500-PD digital voice recorder at the exact time they occurred, for preferably one hour. Notes, such as time of first blow and each dive (fluke up or shallow dive) were also dictated. Encounters where more than one whale was present were excluded from the analysis. Observations were categorized into three groups: *undisturbed*, *guidelines* and *intensive*. *Undisturbed* were observations of whales not under the influence of whale watching boats. Whale watching boats were considered as boats within 500m of the whale. *Guidelines* were observations of whales under the influence of whale watching boats following our full set of guidelines and *intensive* were observations of whales under the influence of whale watching boats not following *all* guidelines.

Most observations were carried out from a 5.6 m. aluminum boat powered by a 150 Hp outboard 4 stroke engine. Observations started within 1500 m of the focal animal (measured subjectively or if possible by the use of a rangefinder). The boat stayed preferably at least 500 m away from the focal animal with the engine shut off. If the whale moved away from the boat, the engine was turned on, the whale was slowly approached again and the engine switched off. The boat was not moved in case the focal animal came within the 500 m boundary during observations.

Additional observations of whales in the category *guidelines* or *intensive* were carried out from either the same aluminum boat or from the larger commercial whale watching vessels and a single *intensive* categorized observation was made from land. An observation was categorized as *guidelines* if all guidelines were followed. If at least one of the guidelines were violated the observations were categorized as *intensive*.





**Figure 5.2.1.** Top, counting blows from a humpback whale. Photo: Maria Iversen. Bottom left, a whale watching boat is observed from a distance. Photo: ErikPalo Jacobsen. Bottom right, breaching humpback whale in Nuup Kangerlua. Photo: Fernando Ugarte.

### 5.3 Data analysis

As humpback whales proved hard to find during the field season of 2010, we chose to include blow rates and dive pattern observations collected from a land-based look-out with theodolite observations in 2007-2008 (see Boye *et al.* 2010) along with boat- and land-based observations from 2006 (GINR, unpublished data) in the data analysis. The data sheets and notes from these additional observations were used to divide the observations into the three categories: *intensive*, *guidelines* and *undisturbed*. As the data from 2006 focused only on presence or absence of boats near the whale, several measurements with whale watching boats were discarded as it was not clear to what category they belonged. However, if the notes stated a specific scenario that could help categorization, such as “whale chased by boat” or “whale watching boats not chasing whales”, the observation was included.

To calculate the mean blow rate of each observation, the total number of blows during an observation was divided by the combined surface time of the individual. Surface time was measured from the first to the last blow between long dives. Afterwards a mean blow rate was calculated for each category. Also the ratio between the mean numbers of surfacings before a long dive was calculated for each category. This was done by dividing the number of all surfacings during an observation by all dives for that observation. Afterwards a mean surface/dive ratio was calculated for each category.

Differences between categories were tested using analysis of variance. However because of the variety of data collection methods we were not able to distinguish if measurements were done on the same individuals. Hence, the statistical analysis may violate assumption on independent data points.

## 6. Results

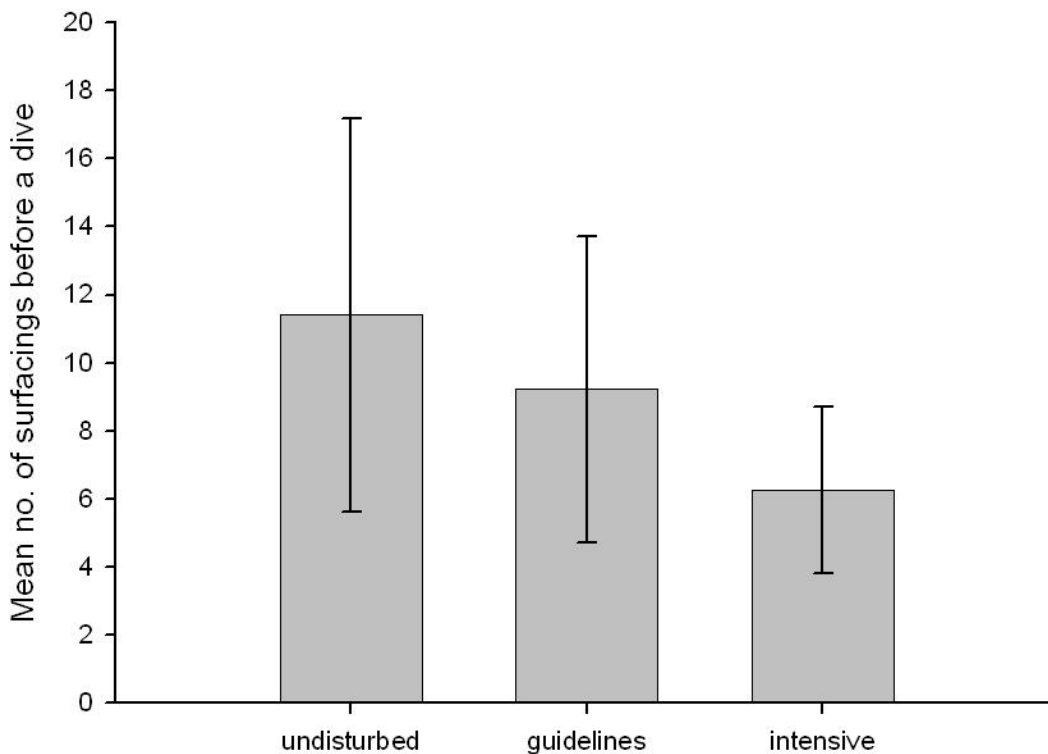
Effort on the water in 2010 was 36 days, where humpback whales were only spotted on 16 occasions, during which *undisturbed* whales were observed 9 times, whale watching boats following *guidelines* were observed on 5 occasions and *intensive* whale watching was observed only 2 times (table 2). After including data from previous years in the analysis, the number of observations increased to 27 *undisturbed*, 8 *guidelines* and 12 *intensive* (table 2).



**Table 2.** Number of observations

Observations of	2010 observations	Total observations (2006-08 and 2010)
undisturbed	9	27
guidelines	5	8
intensive	2	12

We analyzed the surfacing/dive ratios from the total number of observations (n=47). Figure 6.0.1 shows the mean number of surfacings before a dive. There is a significant difference in the number of surfacings between undisturbed whales and whales under intense whale watching (Student's t-test,  $t_{31.74} = 3.65$ ,  $p < 0.005$ ). The whales experiencing *intensive* whale watching almost halved the amount of surfacings before a dive compared to the *undisturbed* whales (6.3 surfacing opposite 11.4 surfacings).

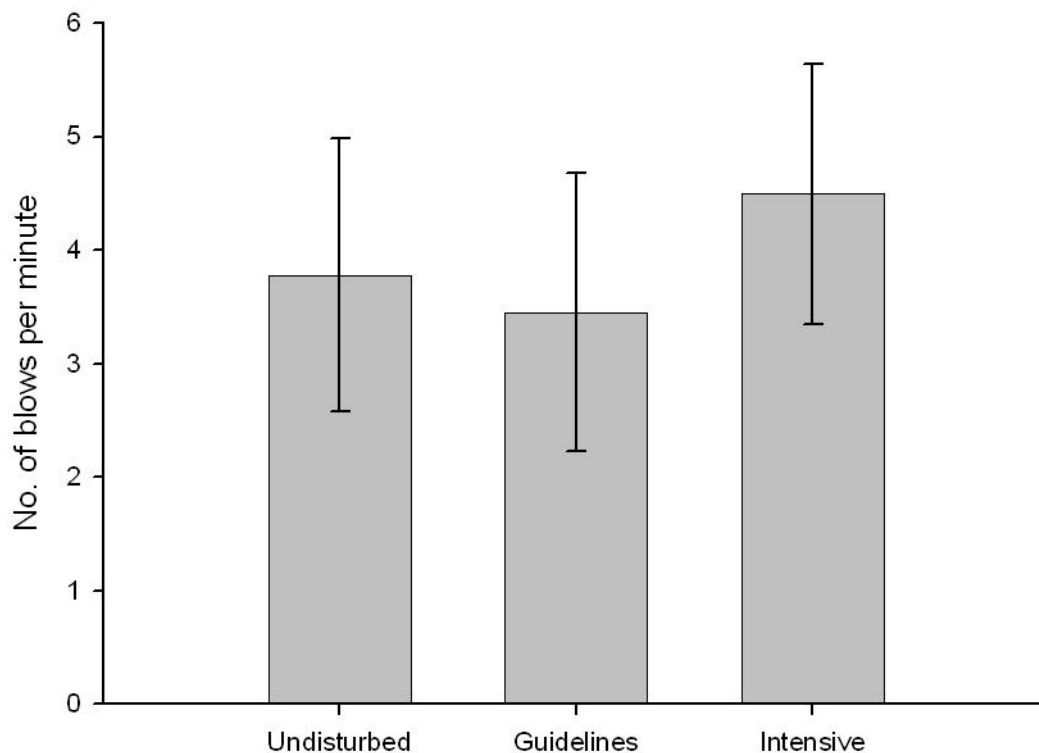


**Figure 6.0.1.** The mean number of surfacings before a dive for the three categories (*undisturbed*, *guidelines* and *intensive*).

The mean number of surfacings for encounters categorized as *undisturbed* (11.4 surfacings before a dive) and *guidelines* (9.2 surfacings before a dive) did not differ significantly (Student's t-test,  $t_{28} = 0.92$ ,  $p = 0.37$ ) but neither did the encounters categorized as *guidelines* and the *intensive* (Student's t-test,  $t_{8.27} = 1.60$ ,  $p = 0.15$ ), though there seemed to be a decreasing trend in the number of surfacings (Fig. 6.0.1). Because the results for *guidelines* cannot be statistically separated from either of the two other categories, more observations of each

category are needed to conclude whether the guidelines tested during the 2010 field work are more comparable to the results of the *undisturbed* category than the *intensive* category. However, the figure expresses the tendency that guidelines may work to reduce the impact of boats on whale behaviour in terms of the number of surfacings.

The mean blow rate did not differ statistically between the 3 categories (ANOVA,  $F_{2,44} = 2.11$ ,  $p=0.13$ ) but there was a slight tendency for whales to increase their blow rate when under the influence of intense whale watching (Fig. 6.0.2). The mean blow rate for whales experiencing whale watching in the category *guidelines* (3.45 blows/min) was close to significantly lower than the mean blow rate for whales under *intensive* whale watching (4.50 blows / min) (Student's t-test,  $t_{18} = 1.94$ ,  $p=0.07$ ). Also the mean blow rate for *undisturbed* whales (3.85 blows / min) was lower than mean the blow rate for whales under *intensive* whale watching (Student's t-test,  $t_{37} = 1.59$ ,  $p=0.12$ ). Blow rate for *guidelines* and *undisturbed* did not differ much (Student's t-test,  $t_{33} = 0.85$ ,  $p=0.40$ ) with 3.45 blows / min for *undisturbed* whales and 3.85 blows / min for whales watched by boats following *guidelines*.



**Figure 6.0.2.** Blow rate per minute of *undisturbed* whales, whales experiencing whale watching according to the *guidelines* and whales under *intensive* whale watching.

## 7. Discussion

Humpback whales were hard to find in Nuup Kangerlua in 2010 and we only encountered whales on 16 out of 36 days. Therefore we included observational data from previ-

ous years and these data were also categorized as *undisturbed*, *guidelines* and *intensive*. Since the collection of data in 2006 was not designed to test these specific guidelines, it is uncertain to what extent the criterion for the category *guidelines* is fulfilled in the data from 2006 with the same rigour as in 2010.

Yet, with these uncertainties in mind, the results of this study do reflect a tendency that the guidelines tested reduce the impact that boats can have on whale behaviour. Undisturbed whales almost doubled the amounts of surfacing compared to whales in the *intensive* category (11.4 surfacing opposite 6.3 surfacings). Although there was no statistical significant difference in surfacing/dive ratio between *guidelines* or *intensive*, whales under the influence of boats following guidelines tended to behave similar to undisturbed whales: surfacing more than whales under intense whale watching and also their blow rate tended to be lower. Blow rate is known from other places to change during whale watching (Jahoda *et al.*, 2007) as a result of changed behaviour of the whales. The slight tendency, in this study, of whales in *undisturbed* or *guidelines* to have a decreased blow rate compared to whales under the influence of intense whale watching suggests that guidelines lower the negative impact of whale watching on whale behaviour.

Yet, all three categories were not clearly separable except from the surfacing/dive ratio of *undisturbed* and *intensive*. Aside from the small sample size and mixture of data which are believed to cause the main ambiguity, the small differences observed between categories may also reflect that the guidelines tested might have been too liberated or too few. Going through the literature of guidelines the minimum distances to the whales vary. A 50 m minimum distance is mentioned in several guidelines (Carlson, 2009) and the marine wildlife watching guidelines of Antarctica allow a 30 m minimum distance for zodiacs (IAATO, 2007). However, other areas set a “no-go zone” of 100 m to the whale (*e.g.* Australian Government, 2010). We chose a minimum distance of 50 m to formulate guidelines which would not seem excessively limiting but still reduce the negative impact of the boats. In Greenland, guidelines will most likely be put into effect through “standard for good practise” as the number of private boat owners along with the large area where both whales and boats travel make it challenging to enforce a law. It is therefore essential that guidelines appear simple and realistic without being in expense of the whales’ fitness. When testing guidelines it is complicated to assess how important each point of the guidelines is. During this study each guideline was considered equally important, yet the whales may have been more affected by a boat violating the 50 m minimum distance than a boat not slowing down within 500 m of the animal. Still, a violation on either 3 guidelines during this study placed an observation in the *intensive* category. If more observa-

tions were carried out it would be possible to carry out a more detailed test of which of the points in the guidelines were more influential in relation to the effect on the whales behaviour.

The amount of time spent whale watching on each individual was not included in the guidelines tested. Humpback whales in Nuuk are often exposed to long periods of whale watching, since there is a flow of boats leaving the whale while new boats arrive. Our observations do not account for how long whale watching had been going on prior to the start of our measurements. Bejder *et al.* (1999) showed that long interactions with boats may cause animals to change behaviour by avoiding interactions and time margins could be included in guidelines. In Nuuk, however, this is a difficult aspect to incorporate due to the many private whale watching boats.

Several guidelines mention ways to approach the whales. For instance not to approach the whales head on or from directly behind, but instead slightly from behind or front and a little to the side is mentioned in various guidelines (*e.g.* Great Barrier Reef Marine Park Regulations, 1983). This aspect was not tested in this study but according to a commercial tour operator in Nuuk approaching the whales in this way seem to decrease the evasive response of the approached whale (E.P. Jacobsen, pers. Comm.). Although this aspect has not been tested in our study it is relevant to incorporate this way of approaching the animals into the guidelines. It is advisable to consult local tour operators for the implementation and further development of whale watching guides, as they have an opportunity to observe whales on a regular basis. Furthermore, testing additional guidelines is both expensive and time consuming, but it is desirable that the whale watching guidelines in Greenland are reconsidered and revised when new relevant knowledge is available.

A small sample size and a mixture of data complicated the analyses and interpretation of the results in this study and more observations are needed. Yet, the results indicate that the use of guidelines likely help to lower the impact that boats can have on whale behaviour. The simple set of guidelines tested here, suggest that disturbance can be reduced by reducing speed within 500 m, stopping active approaches at 50 m from the whale and avoiding cutting off the whale's swimming direction (Not approaching from front or behind). These guidelines can then be further revised through time and experience to fit Greenlandic conditions.

## 8. Conclusion and recommendations

As a result of the increasing whale watching in Greenland there is a need for the industry to be regulated, as unregulated whale watching has proved to disturb humpback whale behaviour in Nuup Kangerlua.

Results from this study indicate that if a simple set of guidelines are followed, the impact of whale watching is likely to be reduced. Based on these preliminary results we recommend the following set of guidelines (see also Fig. 8.0.1),

- Slow down to “no wake” when within 500 m of the whale
- Do not approach the whale directly from behind or in front
- Do not actively move closer to the whale than 50 m

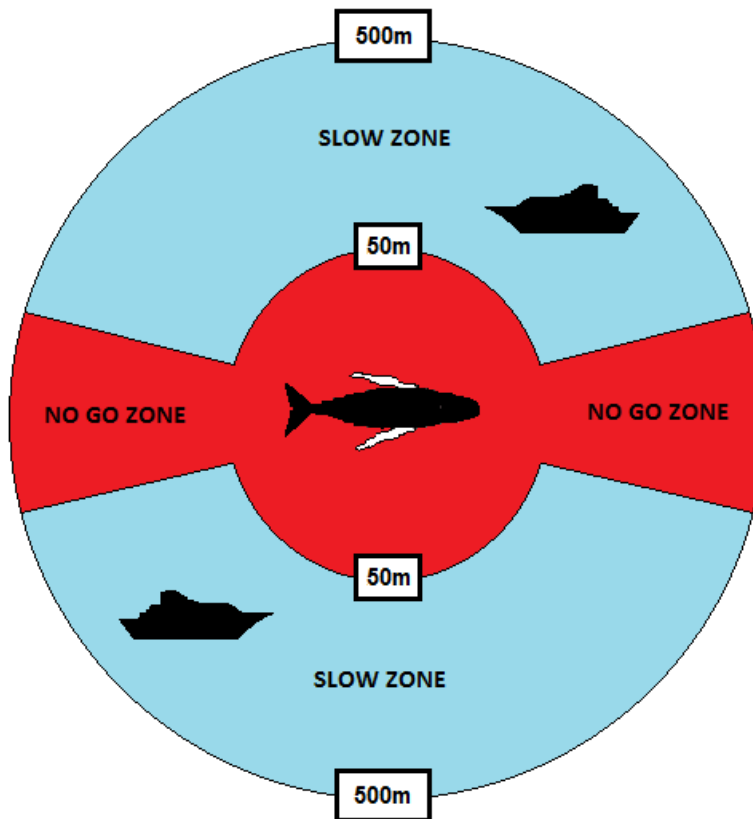


Fig. 8.0.1. The guidelines recommended.

## 8.1 Acknowledgements

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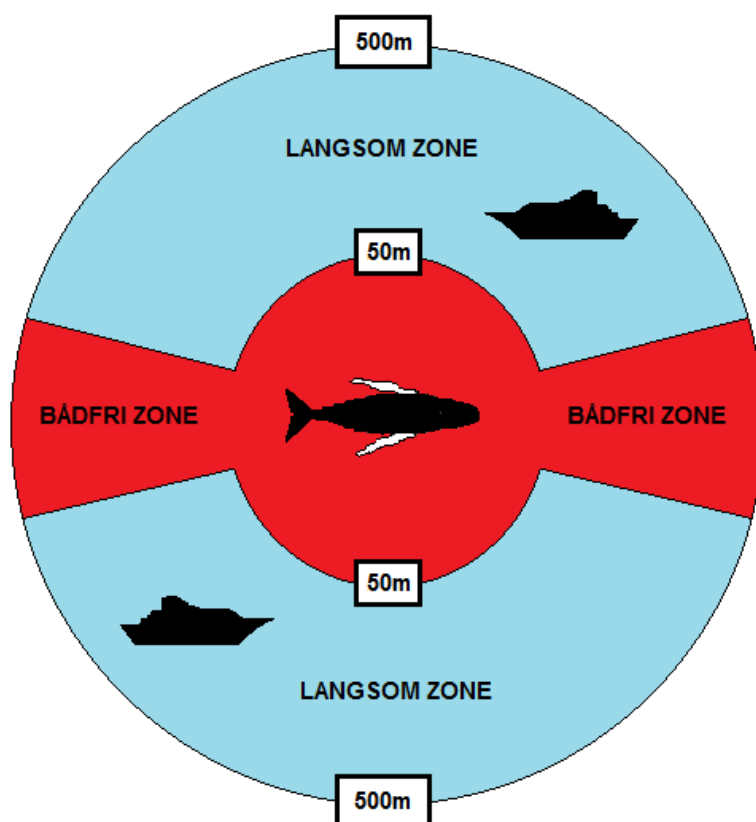
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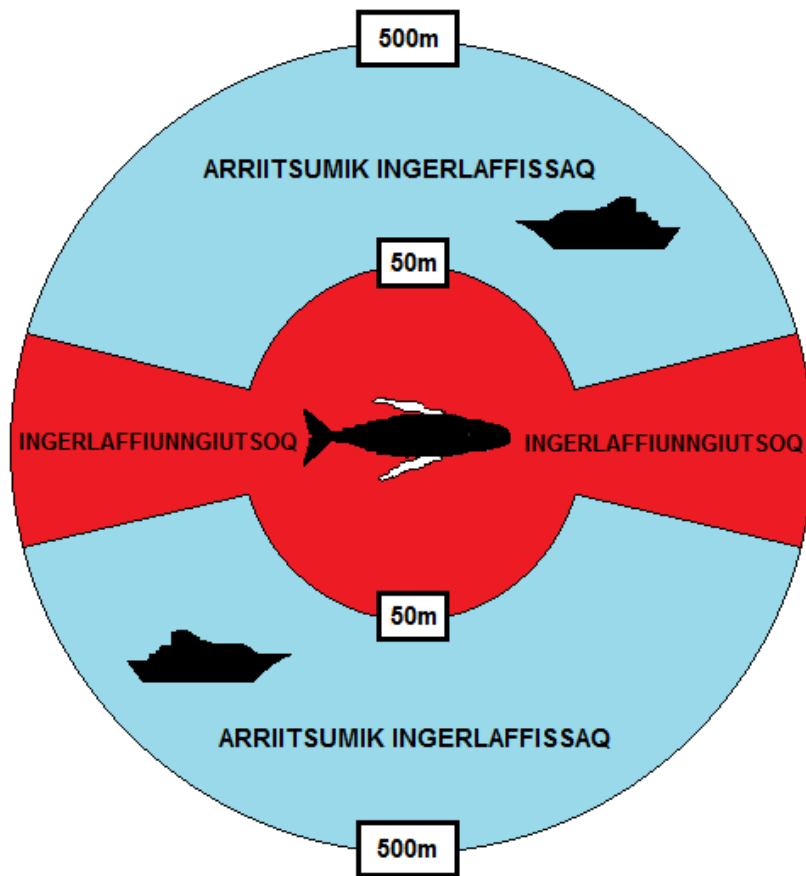
## 10. Appendix

### I. Dansk version af retningslinjer



- sæt farten ned (ingen hækbølge) inden for 500m af hvalen
- undgå at sejle mod hvalen direkte for- eller bagfra
- sejl ikke aktivt indenfor 50m af hvalen (sæt motoren i tomgang eller sluk den)

## II. Malittarisassat kalaallisut allanneqarnerat



- arfeq 500 meterisut ungasitsigisup iluaniitillusi sukaalligitsi (salleraaqarnaveersarneq)
- arfeq tunuaniit sioraaniillu orninnaveersaarsiuk
- arfeq 50 meterisut qanitsigisumiitillugu motoori sarpissortinnasiuk unitsissiulluunniit