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# Approach to a definition of near misses

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INTERNATIONAL WHALING COMMISSION

# Approach to a definition of "near misses"

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Ship strikes today are considered to be one of the major threats to many cetaceans, and in some cases may challenge the long-term survival of local populations. For some time, the discussions around the issue of ship strikes have considered incidents of near misses, and some cases and descriptions have been used in the scientific literature. However, a general definition of what a near miss actually is and which criteria shall be used to define it, are missing to date.

The advantages of having a clear definition include:

- The quantification of the occurrence of near misses
- The comparability between studies trying to assess collision risk in different areas and with different vessel types and cetacean species
- The ability to develop a baseline for performance measures of proposed mitigation activities
- The possibility to register such incidents in databases like the IWC global ship strike database from which statistically significant sample sizes can be reviewed to develop proactive mitigation measures

We therefore expand here on some of the aspects that we think have to be considered when working towards a definition that may be used widely, including a reflection on the crucial issues and questions.

***What is a near miss?***
Near misses are unplanned events that did not result in injury, illness, or damage – but had the potential to do so. In the case of vessel collisions with cetaceans, a near miss involves a vessel and a cetacean in close temporal and spatial proximity having the potential to result in a collision but without physical contact between vessel and animals occurring. In the literature, this event is also termed 'encounter', i.e. " we define the encounter rate as the rate at which an animal and a boat will be close enough in space and time to potentially collide" (Martin et al. 2016).

An example of a near miss could involve a situation where a collision technically and practically is almost unavoidable unless the whale changes its direction or behaviour (e.g. by diving) or the vessel takes immediate action (e.g. abrupt deceleration by changing engine from forward to reverse, considerable speed reduction by putting engine in neutral or dropping sails, and/or immediate change in direction of travel). Sometimes, however, a near miss does not involve any reaction by either the whale or the vessel, or both.

***How should a near miss be defined for the purposes of documentation?***
The way a definition is framed depends on its use. One option would be to simply document near-misses, the critical distance of which will vary based on vessel size and speed and whale species, etc. In our opinion, this becomes problematic as inconsistencies will likely arise as conditions that may have led to a "near-miss" in one scenario may not in the next, which will preclude any meaningful quantification of dependent variables. Hence we propose to **create standardized criteria** that allow for comparability among differing study types to quantify if certain vessel sizes, speeds, whale species etc. have differing rates of near misses. This approach requires a **consistent** independent variable across all studies (set to a specific distance regardless of vessel type, speed etc. and a "near-miss response" defined as eliciting a reaction by either whale or vessel) which we suggest be some distance, as opposed to a fluctuating value.

Further, it is particularly important to distinguish cases where

i) the vessel made an avoidance manoeuvre which was assumed to have averted a collision
ii) the whale made an avoidance manoevre which was assumed to have averted a collision
iii) where the vessel maintained its course but the closest point of approach between the vessel and whale meets the given definition.

***Controllable vs. uncontrollable variables***
Uncontrollable variables include wind, wave height, swell, tide, sun, glare, fog, time of day, moon, and other environmental factors. A dependent, but likewise uncontrollable variable would include the animal's behaviour.
Contrastingly, the principle controllable variable is vessel behaviour as it is the only situation that can be manipulated. It is dependent on vessel type, speed, size, drive, propulsion, hull design, and other physical operating parameters impacting manoeuvrability. It can also depend on crew experience and the presence and number of dedicated observers (see Figure 1).

The challenge is to provide a consistent value for the Closest Point of Approach (CPA) in a near miss, where CPA is defined as closest spatial proximity between a vessel and a whale.

***What variables is the CPA dependent on?***

1. *Speed* has been documented as a factor in the risk of collisions (Conn & Silber, 2013). With increasing vessel speed the risk of a collision is higher also in relation to the distance between vessel and whale (Currie et al., 2015; Martin et al. 2016).

2. *Vessel type*. Physical vessel parameters including, but not limited to, hull design, propulsion, gross tonnage, displacement, manoeuvrability, etc. may also play a role in determining the CPA of a near miss. Also vessel type, and specifically height off the water or position of the bridge, play a role in the distance from which a vessel operator or observer can detect a whale or a dolphin at the surface.

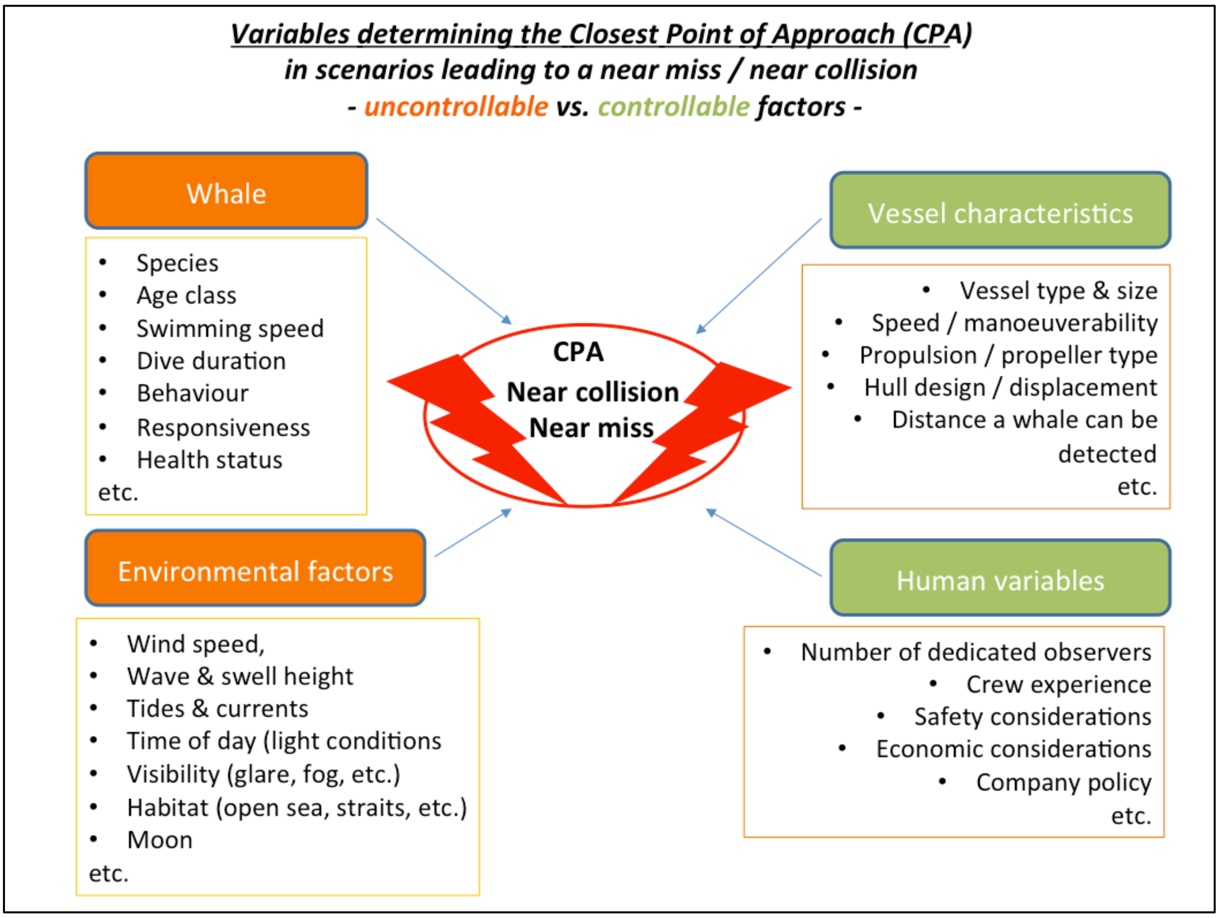
3. *Variability between species and individuals*. Different cetacean species react to vessels in different, and sometimes very characteristic ways. Some species are wary of vessels (such as most beaked whales) and usually avoid them altogether. In larger whales, there are more curious species, such as humpbacks. Collision risk may additionally be dependent on age class as well as individuals. For example, juveniles may be more curious about and less experienced with vessels. As an example, sperm whale calves and juveniles are more vulnerable to being hit by vessels in the Canary Islands (Carrillo & Ritter, 2010).
   *Behaviour and swimming speed of the animal*. A whale will only react after it has i) detected the vessel and ii) realized the need to avoid it. Clearly then, cetaceans can be distracted by certain behaviours like hunting, resting, play, etc. when they are less alert to outside stimuli such as approaching vessels. Dive duration and swimming speed vary depending on species as well as being behaviourally dependent within species which may factor into how or if the animal responds to an approaching vessel.

4. *Human variables*. As with whales, it is important to consider that individual crew members may react differently. Possible reactions include abrupt deceleration by changing engine from forward to reverse, a considerable speed reduction by putting engines in neutral or by dropping sails, and/or immediate change in direction of travel. Individual operators may choose to any one or a combination of these responses. However, it is important to note that many ships, depending on their size, propulsion, propeller type, steering type, etc. cannot effectively deploy evasive manoeuvres in short distances which may result in damage to the vessel. Economic as well as navigational considerations and safety, in instances where ships are carrying passengers, play a vital role.[1]

[1] In informal polls with navigator crew of research vessel 'Polarstern' (four navigators plus captain) it was made clear that the decision for manoeuvre in case of a whale encounter will always depend on the specific situation and no one would propose a fixed distance,

Figure 1 summarizes the variables the CPA is dependent on.

**Figure 1**




***Conclusion***

In the literature, encounters with whales, on both large cruise ships (181-294 m) (Gende *et al.,* 2011; Ritter, 2010) and small vessels (8 m) (Currie *et al*., 2015) have been detected at a distances of ca. 20 m or less, none of which have resulted in a collision. This suggests that a whale can be encountered within 20 m of a vessel ranging in size up to 294 m and still result in no physical impact. The aspects contributing to whale-vessel collisions outlined in this document (whale behaviour, species, vessel crew, vessel type, vessel speed, and controllable as well as uncontrollable variables) likely all play some role for potential collisions or near misses, respectively. However, it becomes problematic if all these aspects shall be incorporated into a definition to be used as a standard for comparison across studies designed to look at the impact of these exact issues. Any vessel with any encounter has the potential to become a collision, given a "worst case" scenario. However, the issue we are trying to define is: when do these encounters become "near-misses", meaning vessel and cetacean become spatially so close together that higher risk of a collision is a given. Defining such a term is of importance, for the reasons highlighted above - and one can then begin to determine guidelines specific to for example: vessel type/speed and species.

The issue of vessels having a bridge so far aft of the bow that a dead angle of 400-500 m exists is an important consideration. However, if the goal of the definition is to allow for comparison across study type, then a vessel which does not have the ability to "view" a near-miss distance will need to be excluded from such quantifications.

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independently of the vessel type. A whale encounter would *à priori* not fit the definition of an 'emergency situation' resulting in immediate manoeuver.

Works presented by Currie *et al.,* 2015 utilized a two-pronged approach, using distances of 300 m and 80 m termed as “Surprise Encounters” and “Near-Misses”. Results of this study, relating speed to probability of Surprise Encounters, in conjunction with other studies relating speeds to encounter distance and lethality (Vanderlaan and Taggart, 2007; Gende et al., 2011), all point to similar speed thresholds of 11-13 kts, suggesting appropriate defining of terms.

On the other hand it can be argued that it is impossible to come up with a single distance as the definition of what a near miss is. Trying to incorporate all the variables listed above into a definition seems in fact a hopeless endeavour. Instead, these variables should be recorded with near-miss reports. In the absence of the feasibility of defining near misses *per se,* we suggest the following way how to approach a definition based on the occurrence of a reaction by the whale or the vessel crew:

**A) Near miss = A reaction was elicited**
A set minimum distance (CPA) between a vessel and a whale, expressed as set multiple of vessel length , e.g. 1.5 lengths of a vessel after a reaction by the animal or the vessel had been initiated This approach would allow for quantification of near misses across studies, species, and vessel types. However, the “fuzziness” of results would be obvious. Therefore, it is necessary that some more metrics will be recorded such as

- vessel type
- vessel speed
- whale species
- reaction (e.g. crew avoid – whale avoid – both avoid)

Any more information around an incident would further reduce fuzziness of results and increase usefulness of the data for statistical analyses.

**B) Near collision = Absence of a reaction**
A set minimum distance (CPA) between a vessel and a whale, irrespective of other variables, e.g. 50 m, 80 m, or the like, in the absence of a reaction (i.e. the whale and vessel just come into close proximity). This approach also would allow for quantification of near misses across species, and possibly across vessel types.

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