



## Swim-encounters with free-ranging killer whales (*Orcinus orca*) off northern Norway - interactive behaviours directed towards human divers and snorkelers obtained from opportunistic underwater video recordings

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The worldwide increase of commercial swim-with programmes targeting wild cetaceans is demanding research on behavioural responses initiated by the animals involved. While the responses of animals being habituated to commercial swim activities have been studied for several species and regions, behavioural studies on in-water encounters with unhabituated animals are still scarce. Such studies are important to illustrate natural responses before commercial operations are established. So far, swim encounters with wild killer whales have not been studied at all. Interactive behaviours initiated by cetaceans and shown in close proximity to human swimmers can be described using an ethogram. Such a behavioural catalogue provides baseline data for managing in-water encounters. During this study, an ethogram of interactive behaviours displayed by wild killer whales (*Orcinus orca*) and directed towards human divers and snorkelers was established.

In January 2015, the first author conducted two swim encounters with wild groups of killer whales in northern Norway. Animals were encountered from an 8m sailing vessel using snorkelling gear. Two persons entered the water simultaneously. Behaviours were documented using an underwater video camera. Additional video material was obtained from three professional filmmakers being recorded during the winter seasons 2000-2015. At a first stage, all videos were scanned for interactive behaviours using the *ad libitum* method. At a second stage, all videos were viewed and analysed again, and the relative occurrence of behaviours per video recording was recorded using one/zero sampling.

Overall, 58 video clips with a total duration of 147 minutes and 32 seconds (minimum length 8 seconds, maximum length 19 minutes 14 seconds [ $\bar{M}$ =2.5 min]) were analysed. The resulting ethogram describes nine interactive behaviours that are considered to be exclusively affiliative in nature. The most frequent behaviours were 'whistling/calling' [ $\bar{M}$ =0.74] and 'eye contact' [ $\bar{M}$ =0.67].

Previously described interactive behaviours found for other unhabituated toothed whales encountering human swimmers and divers were matched in the scientific literature. In contrast, no aggressive behaviours were found during this study, which might be explained by the low data quantity and the applied code of conduct (such as, low swimmer numbers, the prevention of physical contact and the passive behaviour of the swimmers during encounters). The application of footage not being recorded for scientific purposes can give valuable insights into a species' behavioural repertoire notably when relevant information is scarce and data acquisition through field work is difficult (such as extreme weather conditions, the limitation of daylight hours and the low predictability to find the animals in a distinctive area). The present results facilitate the first description of interspecific killer whale behaviours occurring during swim-with encounters with snorkelers and divers which is essential to manage interactions properly in the future. Further research is recommended to obtain a more comprehensive ethogram as well as repetition rates and age/sex-related occurrences of behaviours.