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Boat-based tourism implications for bottlenose dolphin welfare

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Introduction

Boat-based dolphin-watching is a rapidly expanding industry world-wide (Hoyt, 2001), despite limited knowledge of short and long-term behavioural and welfare effects on dolphins (Constantine et al, 2004). The known behavioural changes in bottlenose dolphins (*Tursiops truncatus*), in response to tour boat interactions, include decreased breathing synchrony (Hastie et al, 2003), direct avoidance of location, decreased inter-animal distance, changed headings, increased swimming speed and vertical avoidance (ie increased dive duration) (Nowacek et al, 2001). In order to effectively manage the welfare of bottlenose dolphins, it is necessary to enhance our understanding of the behavioural effects of tour boat interactions. This paper discusses three contemporary studies that focus on such effects.

Discussion

Constantine et al (2004) conducted non-systematic surveys in the Bay of Islands (New Zealand) to examine the effect of tour boats on an isolated population of 400-500 bottlenose dolphins. Behavioural observations were made from a research vessel and eight states (social, forage, rest, slow travel, slow travel-other, travel, fast travel, mill) were recorded. Social behaviour was defined as leaping, chasing, playing and mating, while forage was any effort to capture and consume prey. Rest lacked any active components of behaviour and slow-travel was persistent directional movement at speeds less than three knots. Slow travel-other was slow travel with the engagement of equal amounts of other behaviours. Travel involved persistent directional movement greater than three knots without porpoising (ie leaping clear of the water), while fast travel included porpoising in a persistent, directional movement. Milling was defined as frequent changes in heading and sometimes appeared as a transitional behaviour between other states. The study found the frequency and duration of resting and milling were significantly affected (Constantine et al, 2004). The majority of resting (68%) was observed when the research vessel was alone, decreasing to 0.5% when there were more than three boats present. In contrast, milling increased to 47% whenever three or more boats were present and decreased to 28% when the research vessel was alone. The report proposed that current legislation was inadequate and additional precautionary restrictions (eg limiting trips and reducing prolonged exposure) were required to minimise long-term cumulative effects on dolphin welfare.

Lusseau (2003a) attempted to quantify the behavioural effects of tour boats using Markov chain modelling, which quantified the dependence of one event on preceding events. Sixty five bottlenose dolphins were studied in Doubtful Sound (New Zealand) and five behavioural states (travelling, resting, milling, diving, socialising) were recorded. Behaviour was observed via systematic surveys on a research vessel, which adhered to a strict protocol relating to direction of dolphin approach, boat speed, reduced noise emissions and distance from school. Transitional analyses (ie moving between behaviours) identified the probability of staying in a socialising and resting state decreased with boat interactions, by 75% and 50% respectively. However, the probability of changing from socialising, milling and resting behaviour to travelling almost doubled. Similarly, the stationary probabilities (ie behavioural budgets during boat interactions) also changed with increased time spent travelling and diving and decreased time spent socialising (23% to 12%) and resting (11% to 1%). Lusseau (2003a) concluded that it was not possible to relate significant short-term changes to long-term changes in behavioural budgets.

While studies by Constantine et al (2004) and Lusseau (2003a) identified short-term responses, the long-term effects of tour boats on bottlenose dolphin welfare remain unknown. The synchronisation of behaviours such as resting and foraging are considered important for

group cohesion and group benefits (eg calf care, anti-predator defence, efficiency in exploiting food resources) (Constantine et al, 2004). Furthermore, in long-lived, slow-breeding species like the dolphin the long-term effects of reduced resting on fitness, individual reproductive success and population size could take decades to detect (Wilson et al, 1999).

Changes to diving duration and pattern have also been used to assess behavioural responses to boat interactions. Lusseau (2003b) observed the diving responses of 65 resident bottlenose dolphins in Doubtful Sound and aimed to assess the short-term reactions of male and female dolphins to tour boats. Systematic surveys were undertaken from a research vessel and observations included surfacing times (ie reflects breathing frequency and dive duration) and gender (via underwater camera). Results indicated that tour boats were intrusive by continually breaching distance and duration guidelines. Dolphins displayed vertical avoidance as boats approached and before interactions occurred. This behaviour was attributed to dolphin sensitisation to a perceived threat. In contrast, there was no significant effect of the research vessel on diving patterns. It was assumed that the dolphins were habituated given the vessel had been used for eight years in compliance with guidelines, whereby all interactions with dolphins were terminated at any sign of avoidance. Consequently, there was a possibility that the dolphins did not associate the presence of the research vessel with any potential danger (Lusseau, 2003b).

Lusseau (2003b) unexpectedly identified that both sexes had shorter dive intervals during winter, possibly reflecting the harsher environmental conditions (eg colder temperatures and decreased prey availability). Lusseau (2003b) also observed that males exhibited vertical avoidance earlier than females and females exhibited shorter dive intervals compared to males. This contradicted previous results which showed no breathing discrepancy between the sexes, albeit in a warmer environment (Nowacek et al, 2001). Lusseau (2003b) suggested that females (regardless of reproductive status) may have higher energy requirements which prevent early avoidance strategies. Implications of this study relate to seasonal control of boat-based dolphin-watching. It was proposed that in winter, when environmental stresses are increased, tour boats should be restricted or prohibited. In addition, the review of existing guidelines for tour boats is necessary given the delayed avoidance strategies of females. Critical habitat areas within Doubtful Sound are currently being defined to manage impacts of tour boats and minimise disturbances on crucial dolphin behaviours (eg socialising and resting) (Lusseau & Highman, in press).

The inability to isolate and quantify any behavioural effects from dolphin interactions with research vessels is a limitation generic to all three studies. Constantine et al (2004) and Lusseau (2003a) both recognised the research vessel was a potential disturbance factor within the research method. However, no statistical methods were employed to quantify its effect. In contrast, Lusseau (2003b) used regression techniques to assess the vessel effects. In addition, all three studies lacked true control groups (ie dolphin observations without boats present) due to the need to use boats to observe behaviours.

Conclusion

The results of these studies confirm that tour boat interactions have short-term behavioural effects on bottlenose dolphins (eg decreased resting and socialising, as well as increased milling and travelling) and long-term welfare implications are expected. It is apparent that more research (behavioural, biological and seasonal) is needed into the long-term behavioural implications. Furthermore, extrapolation of seasonal effects could be applied to other locations with similar seasonal and environmental conditions. Until further research is conducted, precautionary measures should be employed to protect bottlenose dolphin welfare (eg introduction and enforcement of boat-based dolphin watching guidelines).

References

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