

Unsustainable dolphin-watching tourism in Fiordland, New Zealand

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Abstract

Bottlenose dolphins are a key resource of the tourism industry in Fiordland and are used on a daily basis by the tour operators offering cruises on the fiords. Recent studies have shown that the current levels of dolphin-boat interactions in this region cannot be sustained by bottlenose dolphins. Interactions have both short- and long- term effects on both individuals and their populations. Recent preliminary modelling work is showing that these effects can consequently be affecting the viability of the three bottlenose dolphin populations living in Fiordland, particularly the Doubtful Sound population and the population utilising Milford Sound which are exposed to higher interaction intensities. While we provided advice in 2002 to mitigate these effects, no management steps have been taken since then. As predicted in 2002, we are currently observing drastic changes in the bottlenose dolphin population living in Doubtful Sound which can be linked to the level of boat interactions to which they are current exposed. We argue that immediate steps need to be taken to mitigate the impact of tourism on this population which now numbers 56 individuals, representing a 20% decline in population abundance over the past 5 years. The creation of a multi-level marine mammal sanctuary would help, as we previously argued, minimise dolphin-boat interactions and still allow for the tourism sector to continue growing in Fiordland.

KEYWORDS: WHALE WATCHING; SUSTAINABILITY; CONSERVATION; MANAGEMENT PROCEDURE; REGULATIONS; SANCTUARIES

Introduction

Fiordland is one of the key destinations for international travellers visiting New Zealand as well as for New Zealanders. In 2002, 450,000 people visited Milford Sound and 41,000 visited Doubtful Sound, nearly all undertaking scenic cruises in those fiords (DoC 2006). This represented 58% of all visitors to the New Zealand Southland region in that year (TRC 2005). In 2004, more than 1 million people visited Southland, a 29% increase from 2002 (TRC 2005). There was no estimate for the scenic cruise component of the industry but the increase in participation was most likely similar or higher. Recent economic analyses show that tourism is one of the strongest assets of Fiordland accounting for 12% of jobs in the Southland region of New Zealand and providing NZ\$368 million/year (US\$ 233 million) for that region (Southland Tourism Strategy 2005). Fiordland is a young tourism destination in New Zealand and is currently undergoing a rapid expansion (only 247,000 tourists visited Milford Sound in 1992) on which the region is understandably eager to capitalise by increasing tourism opportunities (Tourism Resource Consultants 2005).

People come to Fiordland to experience wilderness and many undertake scenic cruises on the fiords. The scenic cruise industry relies on bottlenose dolphins as one of their key assets (Lusseau 2005b), it is therefore crucial to maintain viable populations of this species in the region and prevent any activities that may alter the biology and/or ecology of those populations. Failure to do so, as we argued before (Lusseau 2004, 2005a; Lusseau and Higham 2004; Lusseau et al. 2002), will undermine the

sustainability of the scenic cruise industry in this region and taint the “Green Image” of New Zealand which attract so many visitors to this country.

Fiordland is home to three small populations of bottlenose dolphins (*Tursiops* sp.) which seem to have highly restricted social and genetic interactions (Lusseau et al. 2003; Williams et al. 1993) (de Tezanos Pinto, unpublished data 2005). They are the southernmost resident populations of the species and are therefore subjected to higher environmental stress relating to life at high latitudes (Schneider 1999). All three populations regularly interact with tour boats with varying degrees of intensity. In the period 2000-2002 more than 8500 boat tours per year were offered in Milford Sound, 1700/year in Doubtful Sound and a much lower level, not quantified, occurred in Dusky/Breaksea Sound (Lusseau 2004). During those years, dolphins spent 11% of their time interacting with boats in Doubtful Sound and, intriguingly, exposure to interactions was similar in Milford Sound (13%). A study was carried out at that time to quantify the effects of boat tours on these populations of dolphins. We present here a short overview of the main findings of this study, the recommendations that were made to achieve sustainability and an update on the implementation of these recommendations.

Boat interactions affect the biology of Fiordland bottlenose dolphins

In Milford Sound, a large proportion (8-10%) of dolphins in the population were bearing marks of physical injuries caused by boat strikes (Lusseau et al. 2002). One calf was also shown to have been killed by a tour boat in 2002 (Lusseau et al. 2002), this reduced the reproductive success of the population that year by 50% since only two calves were born in the population.

Monitoring the respiration rate of individuals can help in understanding the physiological constraints they are faced with since this physiological parameter is directly linked to metabolic demands. We followed individuals and recorded the time elapsed between surfacings with and without boats present as well as depending on the behaviour of boats (whether the boats violated the New Zealand Marine Mammal Protection Regulations). We observed typical vertical avoidance during interactions with boats and regulation violations had an additive effect for females (Lusseau 2003b). The more violations were committed during an interaction, the greater the increase in dive interval for females (Figure 1). By contrast males were not as affected by violations (Figure 1). Moreover, the effect on females was substantial with an 18.6% increase in dive interval when one violation occurred, and 37.1% increase for more than one violation.

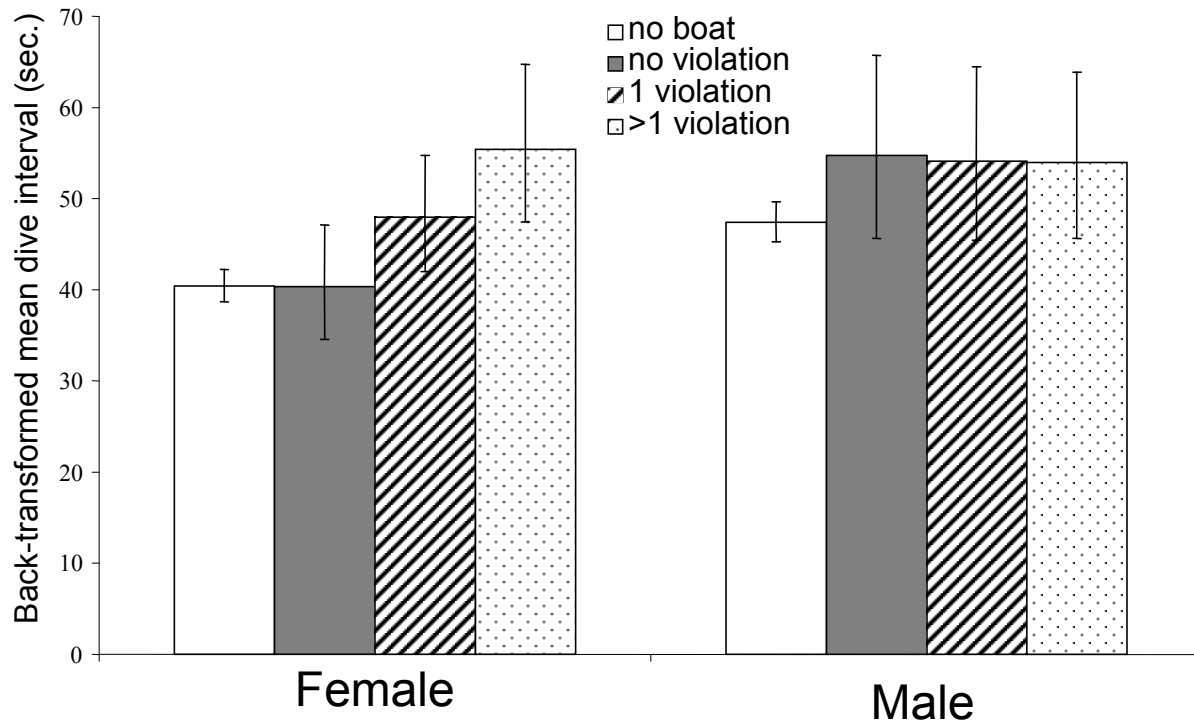


Figure 1. The effects of committing one or more violations of the MMPR during interactions with females and males dolphins on the mean dive intervals. Error bars are 95% confidence intervals.

Following a predator avoidance strategy model, we concluded that the observed extra energetic demand on females, related to their metabolic rate and smaller size, prevented them from vertically avoiding a perceived threat (Howland 1974). They would have therefore only increased their dive interval when necessary, i.e. when the threat is real (e.g. risk of injuries for example) during intrusive interactions. Males would have more energy available to avoid any potential problem via short-term vertical avoidance. This showed that responses to boat interactions had a significant biological cost that may be difficult to be met by females. Having to meet this cost could result in reduced reproductive success for females (Moberg and Mench 2000).

Boat interactions affect the behavioural budget of Fiordland bottlenose dolphin populations

In both fiords the behavioural budget of dolphins changed significantly during boat interactions in a similar fashion (Lusseau 2004). These interactions disrupted significantly the dolphins' resting behaviour and increased the amount of time they spent travelling, to horizontally avoid boats (Figure 2). These changes did not alter the overall behavioural budget of the populations because schools of dolphins did not spend enough time exposed to boats. However, comparing both fiords showed that this short-term behavioural disruption strategy was no longer advantageous if there was

typically less than 68 minutes between two boat interactions (Figure 3). Beyond this threshold the time elapsed between two boat interactions was no longer directly related to the number of boat trips undertaken but remained constant. This shows that dolphins actively avoided boat interactions in order not to exceed this interaction frequency threshold. In order for the behavioural budget of dolphins, and consequently their energetic budget, to not change significantly, dolphins switch to long-term area avoidance when boat interactions were too frequent (Lusseau 2004, 2005a).

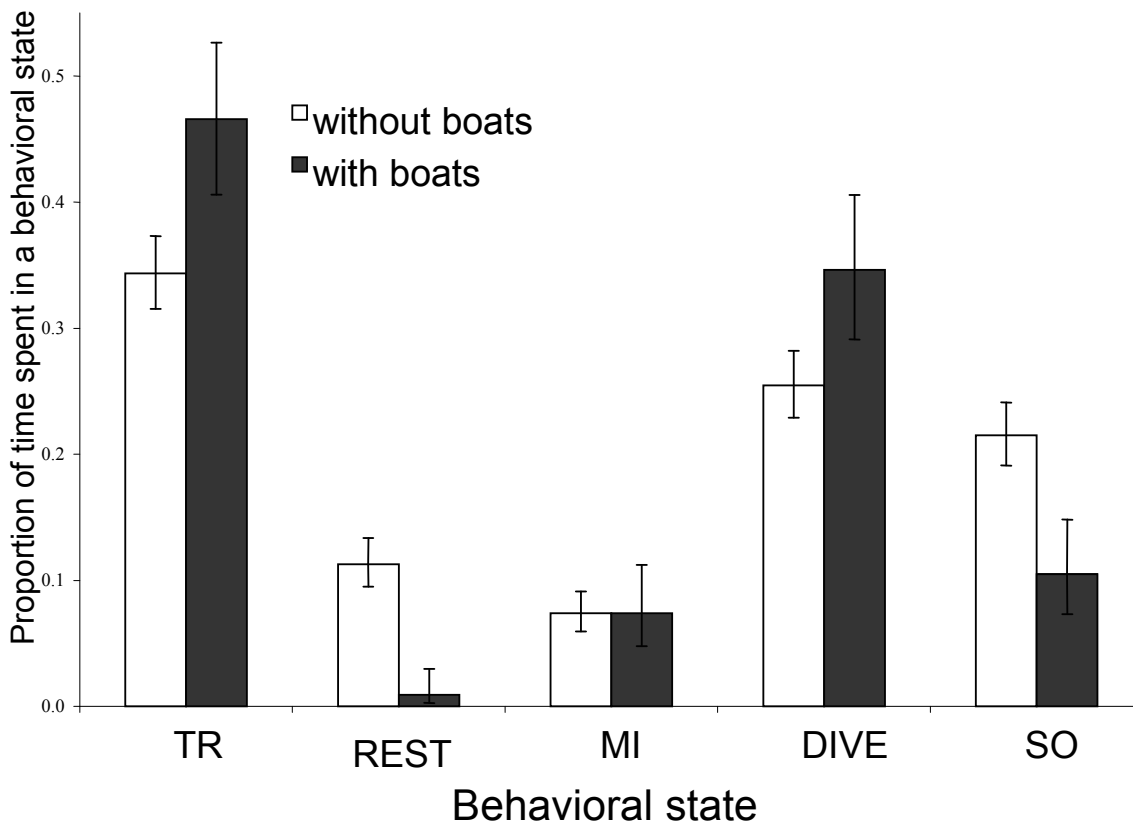


Figure 2. Behavioural budget of bottlenose dolphins in Doubtful Sound, New Zealand considering whether they were interacting with boats or not (adapted from Lusseau 2003a). Error bars are 95% confidence intervals. Dolphins spent less time resting and socialising and more time travelling and diving when boats were present. See Lusseau (2003a) for more details.

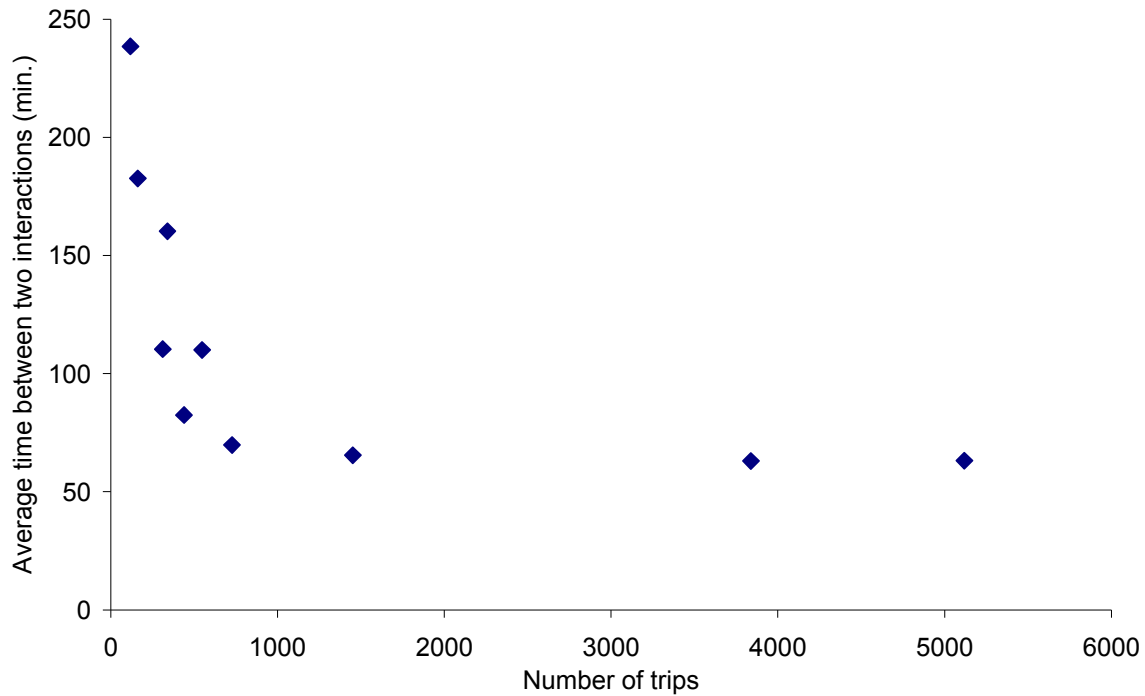


Figure 3. The average time spent between two interactions with boats each season in Fiordland in relation to the number of boat trips offered in the same location during that season. The average time between two interactions is estimated using the likelihood to spend the time between two samples without interactions both in Milford Sound and Doubtful Sound (see Lusseau 2004 for details).

Boat interactions affect the ecology of Fiordland bottlenose dolphin populations

This long-term area avoidance strategy resulted in the displacement of dolphins from their habitat; dolphins avoiding altogether the fiord when boating intensity was high (Lusseau 2005a). This meant spending significantly less time in Milford Sound during tourism peak seasons (Figure 4) and that their residency pattern was significantly negatively related to boat traffic. When dolphins visited Milford Sound they also avoided being inside the fiord, i.e. where boats cruised, during peaks in traffic (Figure 5). The likelihood that they would be found inside the fiord when present in Milford Sound was also significantly negatively related to boat traffic.

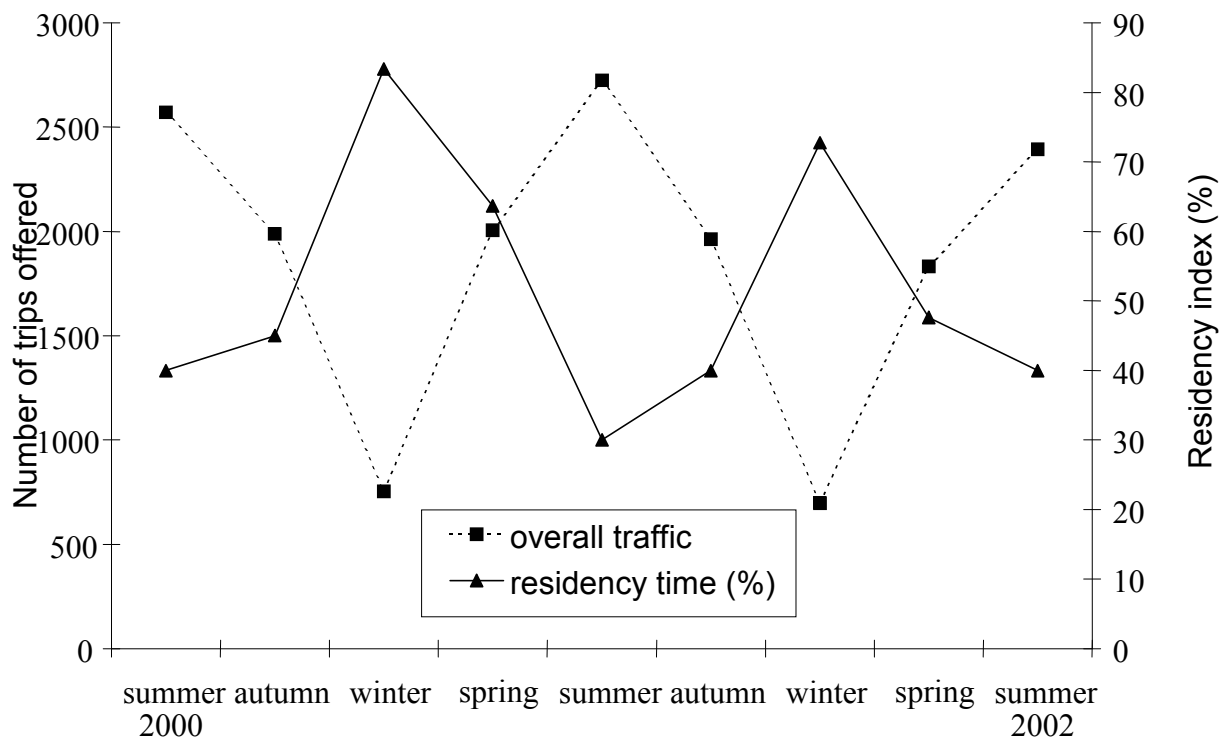


Figure 4. The relationship between the number of boat trips offered each season and the seasonal residency index of bottlenose dolphins in Milford Sound between December 1999 and February 2002. The residency index is the number of days when dolphins were present in the fiord related to the number of days of field effort each season.

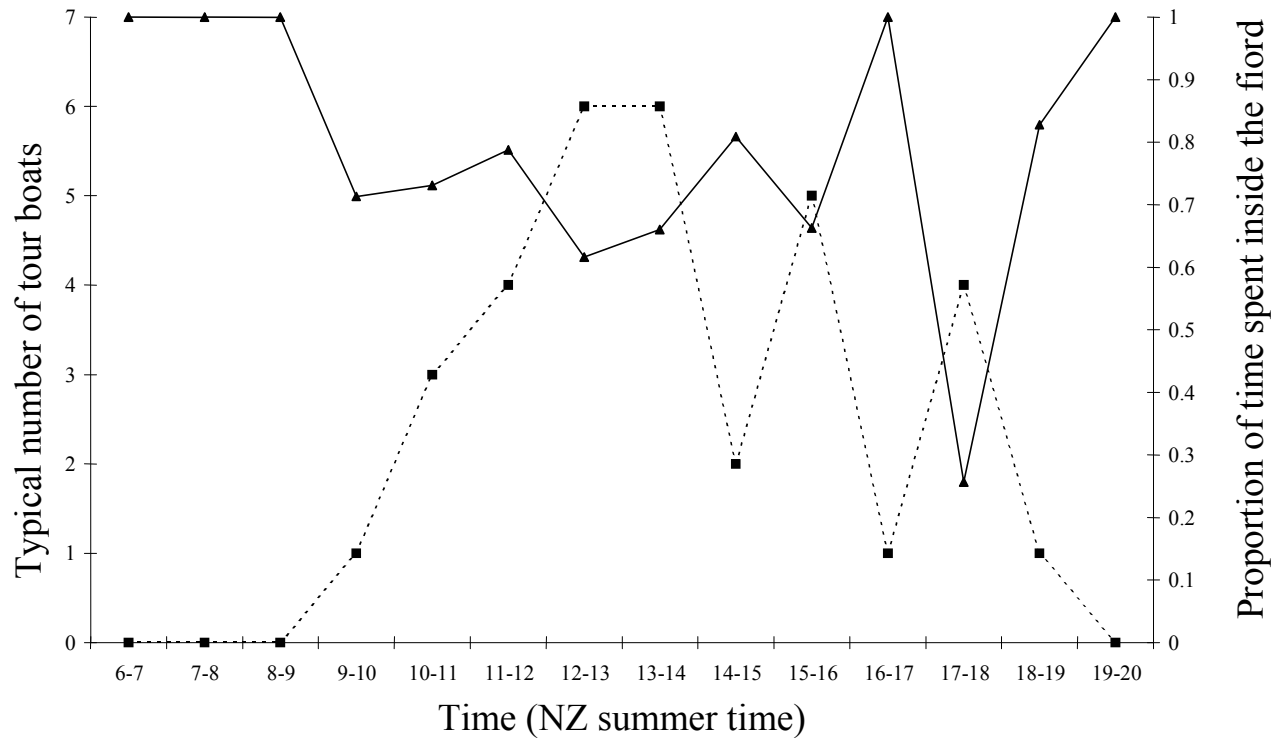


Figure 5. Relationship between the typical number of vessels present in Milford Sound every hour and the use of the fiord by bottlenose dolphins between 6am and 8pm. Habitat use is described as the proportion of time spent inside the fiord to the total observation time for each hour class. Hours are given in New Zealand summer time. The solid line represents the proportion of time dolphins spent inside the fiord. The broken line represents the typical number of boats present any given hour.

Solutions for sustainable tourism

These findings resulted in a conundrum: how can these impacts be resolved without impeding tourism growth? Interactions between boats and dolphins needed to be limited, especially when dolphins were resting and socialising, but boats that held dolphin watching permits still needed to be able to access this resource. We proposed the creation of a multi-level marine mammal sanctuary (Figure 6) in order to resolve this conflict (Lusseau and Higham 2004). The idea behind the sanctuary was to provide dolphin-watching permitted operators with more opportunities to encounter dolphins than other operators in the area, and provide dolphins with no boat zones. This zoning would result in restricting access for only 15% of the fiord, in the case of Doubtful Sound, and provide no-boat zone status to 50-60% of locations where dolphins were observed resting and socialising.

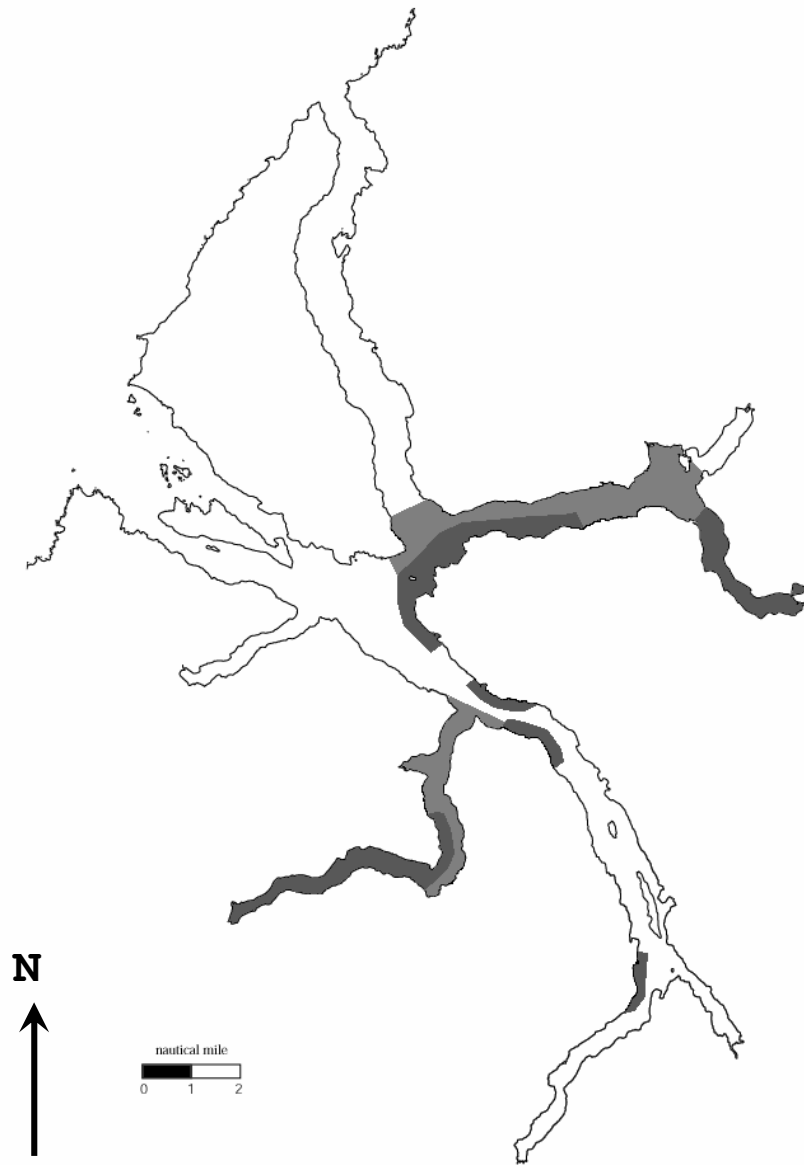


Figure 6. Proposed multi-level marine mammal sanctuary in Doubtful Sound. Dark gray areas correspond to no-boat zones. Light gray areas correspond to location where only tour operators that possess a dolphin-watching permit and researchers are allowed. At present this sanctuary would apply to tour operators and researchers only. Non-targeting general traffic needs to be minimised as well in the protected zones. No wake/no interactions corridors can be provided within the light gray zones to reach safe anchorage.

Conclusions

In 2002, the study reached the following conclusions:

“On a long-term basis, bottlenose dolphins cannot sustain the types of activities undertaken by the scenic cruise industry in Doubtful Sound. The tourism sector is currently at a crossroad in this fjord... Sustainability can be achieved if the results of this study are incorporated in a management framework. If the current development scheme is left unaltered the industry will impact upon both the local natural resources and the local community beyond repair. Moreover, the activities offered in the fjord will not match the expectation of visitors, which will irrevocably compromise the economic sustainability of the tourism operations.” (Lusseau 2004)

“It is necessary to place a limit on the number of trips that can be offered by *all* companies utilising Milford Sound” (Lusseau et al. 2002)

This advice was delivered in 2002. Unfortunately these recommendations have not been applied to the management of tourism in Fiordland. This year a new company was granted consent to operate in Milford Sound. Facilities at the harbour have also been expanded in 2005-2006 in order to accommodate more tourists. The growth of the cruise industry in Doubtful Sound has also continued unchecked, with several new tour operating companies starting since 2002. While these new companies are not planning to target dolphins within their tours, since they did not apply for dolphin-watching permits, we clearly showed in the 2002 study that non-permitted operators were still significantly interacting with dolphins (Lusseau 2003a, 2005b) in Fiordland. Therefore despite our advice the New Zealand Department of Conservation has allowed the increase of dolphin-boat interactions in both fiords.

For the first time in 2003 individual dolphins from the Doubtful Sound population were observed in Dusky Sound (Boisseau 2004) and they have been recorded several time since then in this other fiord (Currey unpublished data). The number of stillbirths is increasing in the population (Figure 7) and the population abundance has drastically declined by 20% over the past 5 years (Gormley 2002, Currey unpublished data). All of these observed effects on the population dynamics were predicted from the impacts observed during the 1999-2002 study. While tourism exposure may not be the only factors affecting the current trends of the population, we demonstrated that it could play a key role in the population dynamics observed since 2002. Preliminary individual-based modelling work (Lusseau et al. 2006), based on the results of the 2002 study and recent studies (Bejder 2005; Bejder et al. 2006), show that the current levels of boat-dolphin interactions are highly likely to jeopardise the viability of the dolphin population within the next 30 to 70 years. Population monitoring in Doubtful Sound has helped to reveal these trends. Unfortunately no further study of the Milford Sound population was undertaken after 2002. We therefore cannot report any update on this population.

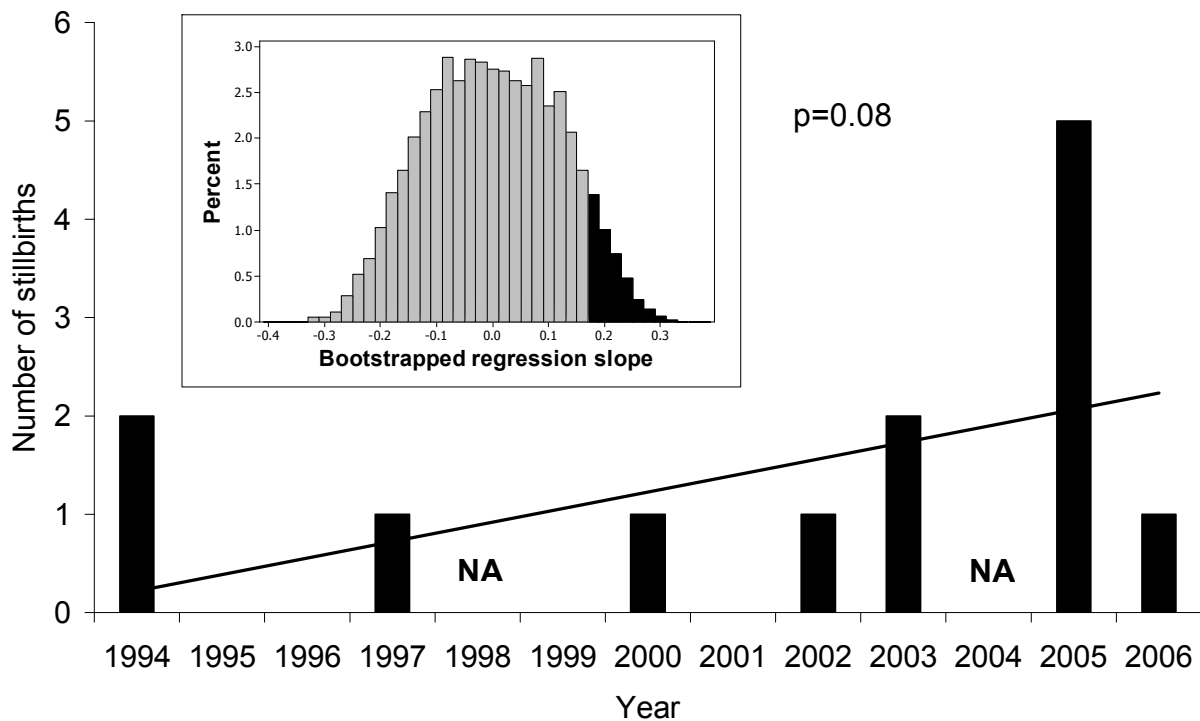


Figure 7. Time series of recorded stillbirth events in the Doubtful Sound population: There is a marginally non-significant increase ($p=0.08$) in the probability of stillbirths over the 13 years by 16% (based on bootstrapped regression slope where the real slope is compared to the slope of randomised data, inset). There was no field sampling during 1998 and 2004 (NA).

While the New Zealand government advocates the precautionary principle in the management of natural resources it is not being applied in the context of the development of dolphin-watching activities in Fiordland. We are urging the New Zealand government to take urgent actions to protect the small and isolated populations of bottlenose dolphins in Fiordland. We re-iterate our recommendation to establish multi-level marine mammal sanctuaries in Doubtful Sound and Milford Sound to minimise dolphin-boat interactions in these fiords and still allow the tourism industry to flourish there.

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