

# Doubtful Sound Bottlenose Dolphin

Threat Management Discussion Paper

SOUTHLAND CONSERVANCY – JULY 2007



Department of Conservation  
*Te Papa Atawhai*

# Doubtful Sound Bottlenose Dolphin

## Threat Management Discussion Paper

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Cover - Doubtful Sound/Patea. Photo: Don Merton

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# Foreword

Research undertaken in the Doubtful Sound complex has identified that the resident population of bottlenose dolphins is in such steep decline that it could face extinction by 2050. As the agency legally responsible for the protection of marine mammals the Department of Conservation is taking these research findings very seriously.

The Doubtful Sound complex is of considerable significance to many stakeholders and iwi. They include agencies who hold legislative responsibilities in Fiordland, those companies that hold consent to undertake a range of activities to those who recreate in this outstanding natural environment. I am aware that there are many different views as to the extent of the threats these dolphins face and until now there has not been an opportunity for all these views, ideas and possible solutions to be considered.

Through this discussion document we have summarised the research findings, outlined the threats believed to be contributing to this population decline and have outlined possible management options which could slow or even possibly prevent this decline.

I ask that you consider this document and provide us with your views, comments and suggestions so that we are able to be fully informed of the possibilities for, and implications of increased protection of the bottlenose dolphins of the Doubtful Sound complex.



Kevin O'Connor  
Conservator, Southland

# Purpose

This paper presents the current scientific information available regarding the bottlenose dolphins (*Tursiops truncatus*) in the Doubtful Sound complex.<sup>1</sup> We are seeking your comments and suggestions on possible options to increase the protection of this population.

The population of bottlenose dolphins in the Doubtful Sound complex was 69 individuals at the end of 1994.<sup>2</sup> By the end of 2006 that number had declined to 56.<sup>3</sup> The number of individuals being added through birth is less than the number of individuals lost from mortality. This decline is one of the steepest ever recorded for a dolphin population that is not exposed to direct or indirect takes from fishing.

- 1 Reference to the Doubtful Sound complex includes: Deep Cove, Hall Arm, Crooked Arm, First Arm, Bradshaw Sound, Gaer Arm, Thomson Sound and Doubtful Sound/Patea.
- 2 Haase, P., K. Schneider. 2001. Birth demographics of bottlenose dolphins, *Tursiops truncatus*, in Doubtful Sound, Fiordland, New Zealand - preliminary findings. *New Zealand Journal of Marine and Freshwater Research* Vol. 35: 675-680 at 677. (95% confidence interval)
- 3 Lusseau, D., E. Slooten and R. Currey. Undated. Unsustainable dolphin-watching tourism in Fiordland, New Zealand. *Tourism in Marine Environments in press* at 4. (Coefficient of variation 1.7%)

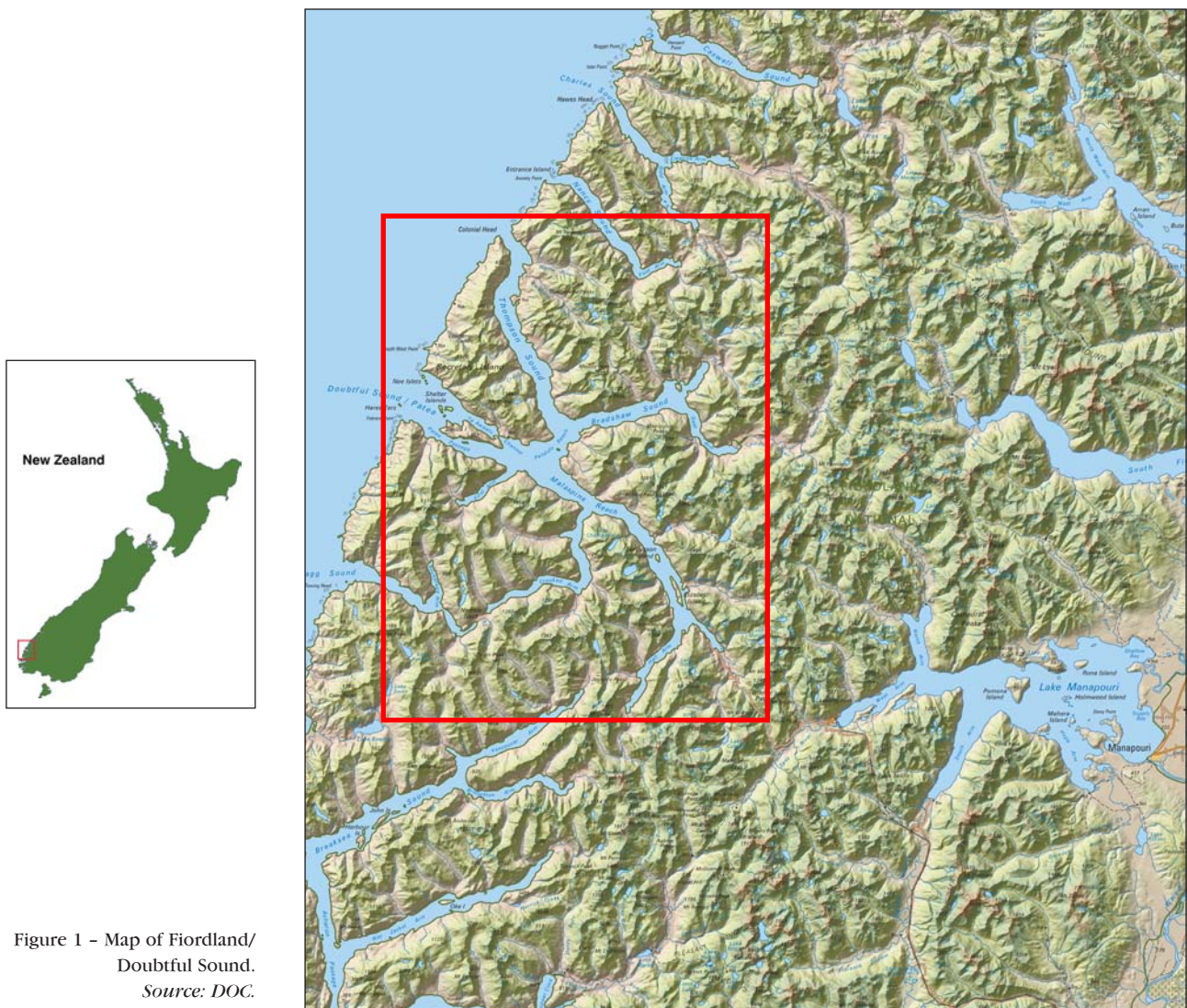


Figure 1 - Map of Fiordland/  
Doubtful Sound.  
Source: DOC.

# Introduction

Fiordland boasts an abundance of marine mammals, including resident populations of bottlenose dolphins. The Doubtful Sound complex population is one of three isolated groups that have been identified in Fiordland, the others being in the Dusky/Breaksea Sound complex and a northern group ranging from Lake McKerrow to Charles Sound.<sup>4</sup>

Alongside growing environmental awareness, international public interest in interacting with marine mammals has increased in recent years. This has contributed to an increased establishment of commercial marine mammal viewing operations throughout New Zealand. Another major factor fuelling the scenic cruise industry in the Doubtful Sound complex is its natural beauty and isolation.



Bottlenose dolphins.  
*Photo: Lou Hunt*

There is strong scientific evidence indicating that the effects of vessels in the Doubtful Sound complex are impacting on the bottlenose dolphin population's viability. It is highly likely that the existing range and intensity of impacts will lead to the Doubtful Sound complex dolphin population becoming extinct within 45 years.

In New Zealand, marine mammals are protected under the Marine Mammal Protection Act 1978. The Department of Conservation administers this Act and is the Government agency responsible for marine mammal welfare in New Zealand. The department has a positive duty to ensure that disturbance to marine mammals is minimal and that detrimental effects caused by human interaction are avoided.

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<sup>4</sup> Boisseau, O.J. 2003. A summary of research conducted on the bottlenose dolphins of Fiordland. Department of Conservation, Southland Conservancy, Invercargill, New Zealand: 34.



# Doubtful Sound Complex Bottlenose Dolphins

## ECOLOGY

- International bottlenose dolphin distribution ranges from Northern Scotland to Fiordland, New Zealand in the south.
- Males reach maximum ages of 45. Females older than 55 have been observed.
- Females become sexually mature at age 12 and can start reproducing then, though with lower reproductive success during their first reproductive years. Males also become sexually mature at age 12, but because of competition with older males are rarely able to reproduce before they reach 18.
- Average calving interval is one offspring every three years with a range of two to five years. Calf survival rate to year one is variable but averages 80%.<sup>5</sup>

## UNIQUE

The Fiordland bottlenose dolphins are unique on an international scale for several reasons:

- Aside from the three populations in Fiordland, no other bottlenose populations in the world are known to reside in fiords.
- They are the southernmost populations of resident bottlenose dolphins.
- These dolphins have a larger body and smaller fins than more northerly populations to help conserve heat. This is likely in order to adapt to the cold water.

Bottlenose dolphins in the Doubtful Sound complex population also have unique characteristics:

- Compared to calving in warmer waters, calving in the Doubtful Sound complex shows strong seasonality, with a peak between December and April. By comparison, populations in tropical regions calve during 10-12 months of the year.
- Average group size in the Doubtful Sound complex has been reported at between 16 and 20 dolphins. There have been sightings of larger groups,<sup>6</sup> however, making groups in the Doubtful Sound complex larger than those observed in resident inshore populations elsewhere.<sup>7</sup>
- The dolphins have distinctive social and cultural characteristics.

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5 Haase, P., K. Schneider. 2001. Birth demographics of bottlenose dolphins, *Tursiops truncatus*, in Doubtful Sound, Fiordland, New Zealand - preliminary findings. *New Zealand Journal of Marine and Freshwater Research* Vol. 35: 675-680 at 675.

6 Currey, R. 2006. Cetacean sightings off the Fiordland coastline. University of Otago, Dunedin, New Zealand. 52 pp at 14.

7 Schneider, K. 1999. Behaviour and ecology of bottlenose dolphins in Doubtful Sound, Fiordland, New Zealand. PhD thesis, University of Otago, Dunedin, New Zealand. 211 pp.

## POPULATION DECLINE

As previously stated, the Doubtful Sound complex bottlenose dolphin population was 69 individuals in 1994. At the end of 2006 the population had declined to 56.<sup>8</sup> Although there have been rare sightings of individual dolphins in other fiords, the Doubtful Sound group remains within the Doubtful Sound complex year round, rarely leaving the fiord for more than a few hours.<sup>9</sup> Because emigration is rare and immigration has never been observed in 16 years of study, the potential exists for this small isolated population to be prone to local extinction.<sup>10</sup>

### Methodology for measuring population size and trend

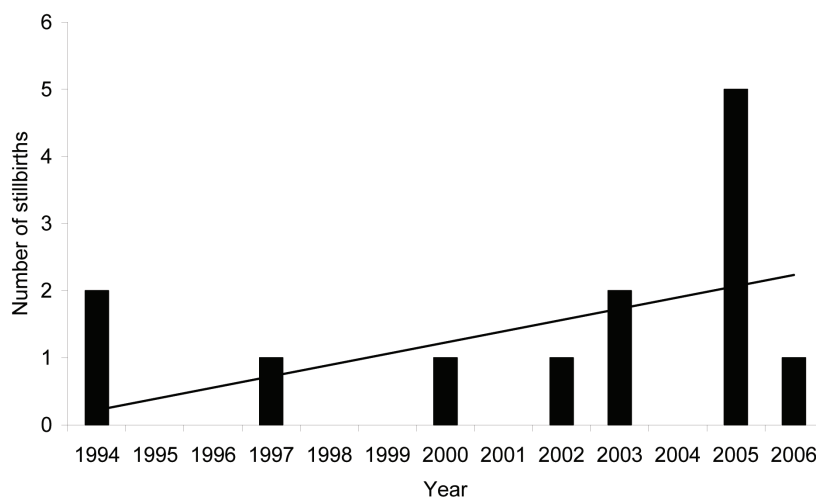
Photo-identification is the process by which individual dolphins are recognised by permanent nicks and notches on their body and dorsal fins. Mark-recapture analysis is a common way to find out the number in a population. This involves repeatedly surveying the population, marking individuals (in this case photo-identifying natural marks) and finding out how often marked individuals are re-sighted. The high frequency re-sighting of individuals in the Doubtful Sound complex population, as well as the high proportion of identifiable individuals with nicks or notches, makes the population estimates accurate.

### Stillbirths

There has been an increase in stillbirths. Between 1994 and 1999, there were 0.6 stillbirths per year. Between 2000 and 2006, this figure increased to 1.6 stillbirths per year. During the 1994-1999 period, stillbirths were recorded in 2 of the 5 years. During the 2000-2006 period, stillbirths occurred during 5 of the 6 years.<sup>11</sup>

If the current decline continues, the Doubtful Sound complex bottlenose dolphin population will be extinct within the next 45 years.

Figure 2 Stillbirth events in the Doubtful Sound complex population. Source: D. Lusseau, E. Slooten and R.J. Currey.



8 Supra, notes 2 and 3.

9 Williams, J.A., S.M. Dawson and E. Slooten. 1993. The abundance and distribution of bottlenosed dolphins (*Tursiops truncatus*) in Doubtful Sound, New Zealand. *Canadian Journal of Zoology* 71: 2080-2088.

Schneider, K. 1999. Behaviour and ecology of bottlenose dolphins in Doubtful Sound, Fiordland, New Zealand. PhD thesis, University of Otago, Dunedin, New Zealand. 211 pp.

Lusseau, D., E. Slooten, J.E.S. Higham and S.M. Dawson. 2002. The effects of tourism activities on bottlenose dolphins in Fiordland: towards a sustainable solution. Department of Conservation, Wellington, New Zealand.

10 Hitchmough, pers. comm.

11 Source: D. Lusseau, E. Slooten and R.J. Currey.

# Legislation

The following chart summarises the main statutes that relate to protection of the resident bottlenose dolphin population. For a more detailed explanation of the statutory instruments involved, see Appendix 2.

TITLE OF STATUTE	PRIMARY OVERSEEING AGENCY	MAIN PURPOSE OF STATUTE
Marine Mammal Protection Act 1978	Department of Conservation	Protection of marine mammals in New Zealand
Marine Mammal Protection Regulations 1992	Department of Conservation	Management of commercial marine mammal viewing operations Conditions governing behaviour around marine mammals
Resource Management Act 1991	Environment Southland	Promotion of the sustainable management of natural and physical resources
New Zealand Coastal Policy Statement	Department of Conservation/ Environment Southland	Management of the New Zealand coastal environment
Regional Coastal Plan for Southland	Environment Southland	Provides direction and rules for coastal management in the Southland Region. It specifically governs of surface water activities in the Doubtful Sound complex
Fiordland (Te Moana o Atawhenua) Marine Management Act 2005	Fiordland Marine Guardians	Preservation, protection and sustainable management of the marine environment and biological diversity of the Fiordland (Te Moana o Atawhenua) Marine Area
Ngai Tahu Claims Settlement Act 1998	Ngai Tahu and Crown/local government bodies	Gives effect to the Ngai Tahu deed of settlement, specifically requiring statutory acknowledgment of the Fiordland Coastal area
Non-Statutory Mechanisms - Code of Practice	Commercial tourist operators	Prescription of specific behaviour around marine mammals

# Stakeholders

Numerous groups have a direct interest in the well-being of the Doubtful Sound bottlenose dolphins. Some of these stakeholders are:

## COMMERCIAL OPERATORS

This group includes all commercial tour and commercial fishing vessels that are consented to operate within The Doubtful Sound complex. A range of tours are offered in The Doubtful Sound complex, including day cruises, vessel day cruises with kayaking, overnight cruises, guided sea kayaking, as well as visits to the fiord by charter vessels and occasional cruise ships.

## RECREATIONAL BOATERS

Due to the isolation of the Doubtful Sound complex, recreational boaters make up a small percentage of the overall boat traffic. This group generally is generally composed of fishers and hunters, but there is still the potential for dolphin encounters.

## DEPARTMENT OF CONSERVATION

Under the Marine Mammal Protection Act 1978 and the Marine Mammal Protection Regulations 1992, the Department of Conservation is the Government agency responsible for marine mammal welfare in New Zealand.

## MINISTER OF CONSERVATION

It is the responsibility of the Minister of Conservation to prepare and approve all Regional Coastal Plans.<sup>12</sup>

## ENVIRONMENT SOUTHLAND

Environment Southland is the statutory body responsible for managing the natural and physical resources in Southland, which encompasses Fiordland.

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<sup>12</sup> Resource Management Act 1991, section 28.

## FIORDLAND MARINE GUARDIANS

This group was formed in response to concerns about escalating pressures on the Fiordland area resulting from increasing use, the need for improved and integrated management of the area and a desire that the community be more involved in the management of Fiordland's marine environment. The strategy the Guardians developed was entrenched in the Fiordland (Te Moana o Atawhenua) Marine Management Act 2005.

## IWI

Fiordland is within the takiwa (area) of Te Rūnanga o Ngai Tahu who is the iwi authority.

## SCIENTIFIC COMMUNITY

The University of Otago has carried out research in the Doubtful Sound complex since 1990. Other academic institutions have also conducted research on the dolphins. Their work has greatly increased our knowledge of the dolphin population.

## THE SOUTHLAND CONSERVANCY CONSERVATION BOARD

Appointed by the Minister of Conservation, the board provides community input on the Department of Conservation's work, advising the New Zealand Conservation Authority and the Director-General of Conservation on the implementation of conservation management strategies and conservation management plans.

Doubtful Sound/Patea.  
*Photo: DOC*



# Boating Operations in the Doubtful Sound Complex

Tourism ventures often seek encounters with dolphins in the Doubtful Sound complex. Scenic cruises take place year round on vessels ranging from kayaks, usually in groups of five or six, to a 40 m catamaran powered by twin diesel engines. The tourist vessel activity in The Doubtful Sound complex during the summer months can be summarised as follows:

- Eight operators focus their trips on the Doubtful Sound complex. One of the operators runs two boats.
- Two of the operators run kayak trips that are offered on both a day trip and overnight or multi-night basis.
- Five of the vessels run overnight or multi-night trips exclusively.
- Two of the vessels operate day trips only.

If each operator has a cruise, this equates to approximately seven vessels and two kayaking groups (one with a support boat) on the water each day. This is often the case during peak tourist season between December and March. During the winter months, boat tours are less frequent and several operators do not run tours. Some operators conduct tours in the fiord only during the winter and are based elsewhere during the summer.

Eight Marine Mammal Viewing Permits have been issued or are in the renewal process for operations that focus on the Doubtful Sound complex. One scenic cruise operator does not have the purpose to view marine mammals and therefore does not have a viewing permit. Commercial vessel operators without a permit must not seek out marine mammals for hire or reward. Any opportunistic interactions they may have with marine mammals must comply with the Marine Mammal Protection Regulations 1992.

## RECREATIONAL BOATERS

Because of the remoteness of the fiord, there are few private recreational boaters. Although they make up only approximately 7.9% of all dolphin-boat interactions, they have the potential to disturb dolphin behaviour.<sup>13</sup>

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<sup>13</sup> Lusseau, D. 2003. Effects of tour boats on the behaviour of bottlenose dolphins: using Markov chains to model anthropogenic impacts. *Conservation Biology* Vol. 17, No. 6: 1785-1793 at 1788.

# Effects of Boating Operations

From 1999 to 2002, an independent research boat conducted 'follows' on dolphin focal groups to assess the effect of boat interactions on bottlenose dolphins in Fiordland. The study compared data from the Doubtful Sound complex and Milford Sound/Piopiotaahi, with the goal of contrasting the magnitude of observed effects with two populations exposed to two different levels of boat traffic. On average, five times more cruises were offered in Milford Sound/Piopiotaahi than the Doubtful Sound complex during the study period.

## A. DEFINING AN INTERACTION

A boat interaction was defined as a vessel coming within 400 m of the dolphins, as this is the distance where dolphins will tend to break off from a group to interact with a vessel. Each time a boat interacted with the dolphins, a number of factors were recorded by the research vessel:

- The time the vessel spent with the dolphins;
- The type of vessel (i.e. private, tour operator with or without Marine Mammal Viewing Permit, fishing charter);
- The minimum distance between the vessel and the dolphins during the interaction;
- Whether the Marine Mammal Protection Regulations 1992 regarding behaviour around marine mammals were breached.<sup>14</sup> Specifically, it was recorded every time a vessel:
  - proceeded at a speed greater than the group of dolphins when within 300 m;
  - proceeded through the school;
  - cut the path of the school;
  - approached the school head-on;
  - circled the school; or
  - proceeded astern (in reverse) within 50 m of the school.<sup>15</sup>

## B. RESEARCH VESSELS

Land-based observations of the effects of boat interactions cannot be carried out because of the remoteness and topography of the fiord. Observations were conducted from a 4.8 m vessel powered with a 50 HP four-stroke outboard engine. A four-stroke engine was chosen to reduce noise emission. The effect of the research vessel was estimated using a regressive approach where the dolphins were subjected to different levels of observation intensity. Three levels of observation intensity were computed and the dependence of dive intervals to these levels examined:

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<sup>14</sup> Lusseau, D. 2003. The state of the scenic cruise industry in Doubtful Sound in relation to a key natural resource: bottlenose dolphins. In: *Nature based tourism in peripheral areas: development or disaster?* (Edited by M. Hall and B. Boyd). Channelview Publications, Cleventon, England. 20 pp at p. 8.

<sup>15</sup> *Ibid* at p.12.

- the vessel following the group at close range (within 50 m);
- the vessel following the group from afar (between 100 and 200 m); and
- the vessel drifting engine off (at least 100 m away from dolphins).

The effect of the vessel was then detected using General Linear Models. If an effect was detected, the study incorporated observation intensity as a parameter. The effect of dolphin-watching activities was then able to be teased apart from the effect of the observing vessel. In this study, the effects of the research vessel were determined to be negligible.<sup>16</sup>

### C. BOAT INTERACTIONS PUT ENERGETIC CONSTRAINTS ON FEMALES

Cetaceans such as bottlenose dolphins have various strategies to avoid interactions with boats. They do not avoid all interactions, but if the interaction becomes too lengthy, intrusive or unpredictable, cetaceans will use various tactics to try to avoid the boat.<sup>17</sup> Dolphins have shown various horizontal and vertical avoidance strategies for evasion. During vertical avoidance, dolphins have to use oxygen stores to deal with the decrease in breath intake.<sup>18</sup>

The sex of the dolphin and the presence of boats, regardless of type of vessel, were the factors that had the biggest effect on average dive interval (the time between two surfacings). Dive intervals were significantly longer when boats were present. To obtain this information, the time between surfacings, the type of vessel and whether a boat was present or absent were recorded. Also documented was whether or not the boat violated the Marine Mammal Protection Regulations 1992 regarding behaviour around marine mammals.

During the study period, it was observed that 70.6% of dolphin-boat interactions violated the Marine Mammal Protection Regulations 1992. Most commonly boats did not respect the speed limit when interacting with dolphins. The more violations that were committed during an interaction, the greater was the increase in dive interval for females.

During an interaction, violations of the Marine Mammal Protection Regulations 1992 increased the dive intervals far more than the type of boat. The dolphins were more affected by the **way** the boat behaved than the **type** of boat, whether it was a kayak or a small or large motorised vessel.<sup>19</sup> Along with the predictability of boats, noise emissions were a component to explaining avoidance tactics. Predictable boat behaviour with no sudden changes in direction or speed is a key to minimising the impact of boat interactions. A commitment to further research is warranted to distinguish the separate effects of each of these variables, including noise, behaviour

16 Lusseau, D. 2003. Male and female bottlenose dolphins *Tursiops* spp. have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. *Marine Ecology Progress Series* Vol. 257: 267-274 at p.269

Lusseau, D. undated. Directions in the scientific aspects of whale watching management. Presentation at Science for Sustainable Whale Watching Workshop, organised by the IWC. 8pp at p.2

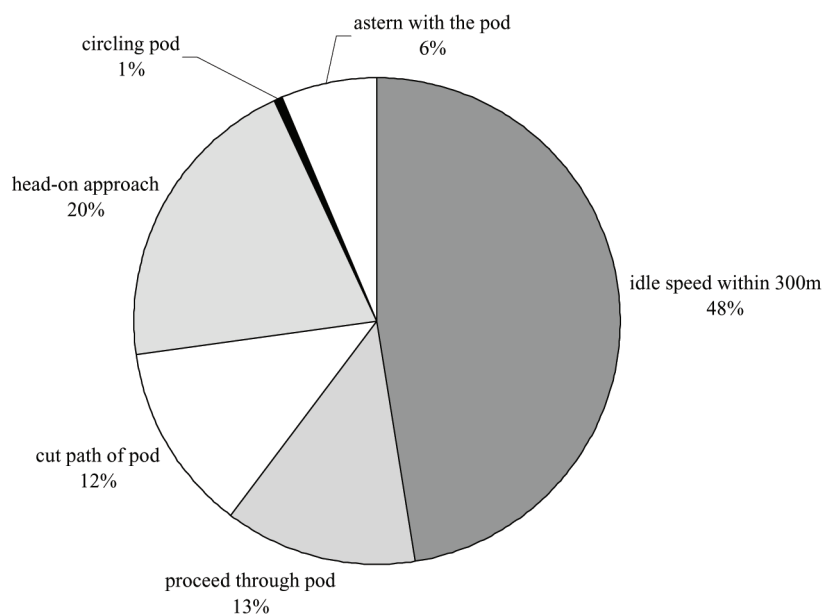
17 Lusseau, D. 2003. Male and female bottlenose dolphins *Tursiops* spp. have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. *Marine Ecology Progress Series* Vol. 257: 267-274.

18 Ibid. at 268.

19 Ibid. at 271.



Figure 3. Types of violations of the Marine Mammal Protection Regulations 1992. Source: Lusseau, D. 2003. The state of the scenic cruise industry in Doubtful Sound in relation to a key natural resource: bottlenose dolphins. In: Nature based tourism in peripheral areas: development or disaster? (Edited by M. Hall and B. Boyd). Channelview Publications, Cleventon, England at 13.



and type of vessel.

The principle behind “predator avoidance strategy” means that an individual exposed to a predator will weigh the costs and benefits of escaping versus hiding. Female dolphins only increased their dive interval during intrusive interventions when the threat was real. Males have more energy available to avoid any potential problem through short-term vertical avoidance. These results showed that responses to boat interactions have a significant energetic cost that females may find difficult to meet. Having to meet this cost could result in reduced reproductive success for females.

#### D. SHARK BAY, AUSTRALIA

A recent study in Shark Bay confirmed that energetic constraints affect females’ reproductive success.<sup>20</sup> Only a small subset of the bottlenose dolphin population in Shark Bay is exposed to boat interactions.<sup>21</sup> The reproductive success of females that were exposed to vessels was half the success of females that were not exposed to boats. It was also found that there had been a decline of 15% in the number of dolphins using the area frequented by cruise operators over the previous five years. Only two tour boats operated in Shark Bay during the study and there was virtually no other boat traffic in the area. The Australian Government’s response to this research was to reduce the Shark Bay licences for marine life viewing from two to one.<sup>22</sup>

20 Bejder, L. 2005. Linking short and long-term effects of nature-based tourism on cetaceans. PhD thesis, Dalhousie University, Halifax.

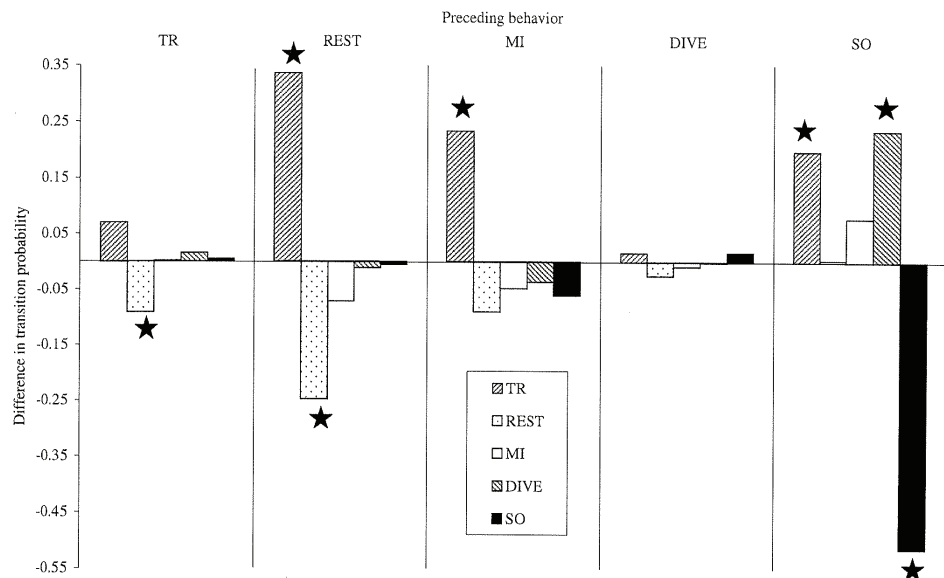
21 Lusseau, D., S. Maersk Lusseau, L. Bejder and R. Williams. Undated. An individual-based model to infer the impact of whale watching on cetacean population dynamics. 19pp at 8.

22 ‘Long-Term Sustainability Central to Monkey Mia Decision’ 26 June, 2006: [www.mediastatements.wa.gov.au](http://www.mediastatements.wa.gov.au).

## E. ALTERATION TO THE BEHAVIOURAL BUDGET

The behavioural budget of dolphins is comprised of five behavioural states. These are travelling, diving, socialising, milling and resting. In all areas of the Doubtful Sound complex, boat interactions considerably disrupted the dolphins' resting and socialising behaviours and increased the amount of time they spent travelling to avoid boats. When boats were present, the time spent socialising was significantly reduced by almost half, and the time spent resting was significantly reduced from 11% to 1%.<sup>23</sup>

Figure 4. Behavioural budgets of dolphins during an interaction with boats and in control situations. Source: Lusseau, D. 2003. Effects of tour boats on the behaviour of bottlenose dolphins: using Markov chains to model anthropogenic impacts. Conservation Biology Vol. 17, No. 6: 1785 at 1792.



It was found that if there was less than 68 minutes between boat interactions in Milford Sound/Piopirotahi, short-term avoidance strategies were no longer advantageous to the dolphins. If the duration between boat interactions was longer than 68 minutes, the dolphins were more likely to use short-term avoidance strategies such as increased diving activity.

Long-term area avoidance results in the displacement of dolphins from their habitat. The Doubtful Sound complex population has not been found to spend significant time outside the fiord. However in 2003, for the first time, individuals from the Doubtful Sound complex population were observed in Dusky Sound. In contrast, the Milford population avoids being inside Milford Sound/Piopirotahi during peaks in traffic. Time spent outside the fiord increases exposure to predators.<sup>24</sup>

In the Doubtful Sound complex it seems that all dolphin schools need to have collectively at least 70 minutes between boat interactions for short-term avoidance strategies to remain advantageous. Since interactions typically last around 15 minutes, this corresponds to approximately five to six interactions a day. After this number of interactions, short-term term avoidance strategies are no longer effective.

<sup>23</sup> Lusseau, D. 2003. Effects of tour boats on the behaviour of bottlenose dolphins: using Markov chains to model anthropogenic impacts. Conservation Biology Vol. 17, No. 6: 1785-1793 at p.1790.

<sup>24</sup> Lusseau, D. 2005. Residency patterns of bottlenose dolphins *Tursiops* spp. in Milford Sound, New Zealand is related to boat traffic. Marine Ecology Progress Series Vol. 295: 265-272 at 270.

## F. NOISE

Marine mammals rely heavily on sound to interpret their environment. It has been suggested that their acoustically sensitive ears are especially vulnerable to noise disturbance and the disruption of communication signals.<sup>25</sup> Observed responses of cetacean species to noise disturbance include:

- displacement;
- avoidance;
- increased dive interval; and
- changes in underwater acoustic behaviour.

## G. SPATIAL BEHAVIOURAL ECOLOGY

Between December 1999 and February 2002, 1,234 sightings of dolphin schools in the Doubtful Sound complex were collected, recording the geographic location and the behavioural state of the dolphins. The analysis of this data showed

that the dolphins were more likely to be resting in Crooked Arm, Gaer Arm, Bradshaw Sound and the north-eastern coast of Doubtful Sound/Patea. It also showed that they were more likely to be socializing at the entrance of Bradshaw Sound and in Bradshaw Sound. Resting and socialising are two states identified in behavioural budget study as sensitive to boat interactions. A critical region is defined as a location that is predominately used for resting and socialising. An important region is an area where socialising and resting are often observed.<sup>26</sup> The research shows that these areas are used similarly year round.<sup>27</sup>

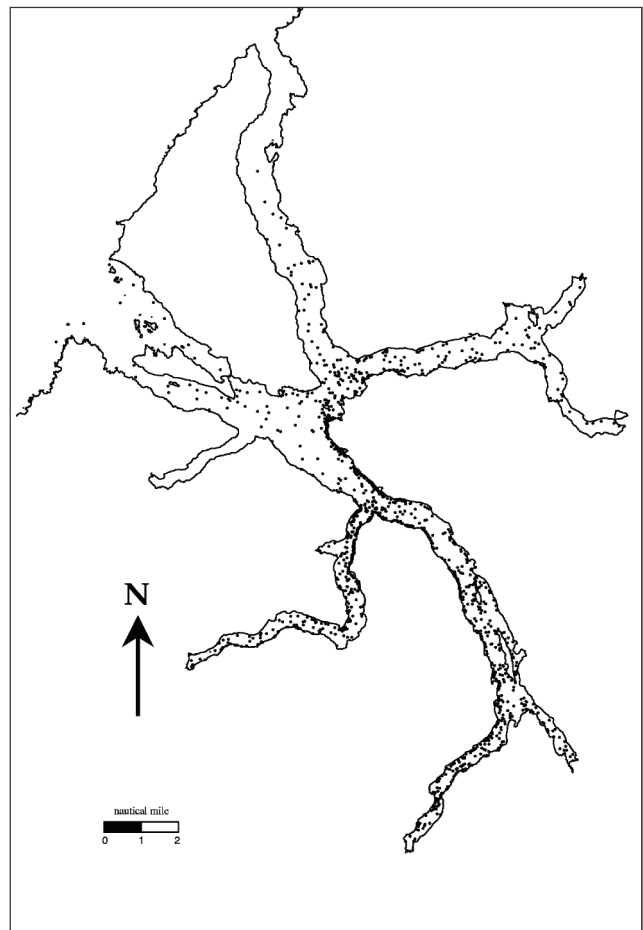


Figure 5. All sightings recorded in the Doubtful Sound complex between December 1999 and February 2002 (n= 1,234). Source: Higham, J.E.S., D. Lusseau. 2003. Managing the impacts of dolphin based tourism through the definition of critical habitats: the case of bottlenose dolphins (*Tursiops* spp.) in Doubtful Sound, New Zealand. *Tourism Management* Vol. 25: 657 at 662.

25 Reeves, R. 1992. Whale responses to anthropogenic sounds: a literature review. Science and Research Series Number 52. Department of Conservation, Wellington, New Zealand.

26 Higham, J.E.S., D. Lusseau. 2003. Managing the impacts of dolphin-based tourism through the definition of critical habitats: the case of bottlenose dolphins (*Tursiops* spp.) in Doubtful Sound, New Zealand. *Tourism Management* Vol. 25: 657-667 at p. 662.

27 Ibid at 664.

Although tourism exposure may not be the only factor affecting the current trends of the Doubtful Sound bottlenose dolphin population, it has been demonstrated to play a key role in the population dynamics. The current level of surface water activity in the Doubtful Sound complex may already be too high for the resident population of bottlenose dolphins.

# Other Threats

Boat interactions are identified as a key cause linked to the decline of the bottlenose dolphin population in the Doubtful Sound complex. However, it is also acknowledged that boat interactions are not the sole factor involved. Alongside the options for increasing the protection of the dolphins, which are discussed later, an understanding of the other threats facing this population and a clear strategy to address these threats must be established.

## BOAT STRIKES

Injuries to dolphins from collisions have been observed in Fiordland. In Milford Sound/Piopirotahi, four bottlenose dolphins bear propeller scars and one two-week-old calf died after being struck by a vessel.<sup>28</sup> The erratic navigation of boats causing propeller strikes obviously affects the abundance of a resident population such as that in the Doubtful Sound complex. The Department of Conservation currently maintains a database with photo identification records of marine mammal boat strikes in Fiordland.

## FOOD SOURCES

Understanding the feeding ecology of bottlenose dolphins in Fiordland is limited by two factors: the tannin-rich surface waters prevent subsurface behavioural observations and carcass retrieval is uncommon, meaning there are few opportunities for autopsies and analysis of stomach contents. However, indirect observations have provided some insight.

Dolphins mainly move in schools hunting fiord wall- and bottom-dwelling fishes as well as pelagic<sup>29</sup> fishes within the fiord. They rarely catch fish or squid from outside the Doubtful Sound complex.<sup>30</sup> The establishment of marine reserves that restrict fishing in the Doubtful Sound complex is an example of an active measure taken to protect the food web in Fiordland.

## FRESHWATER DISCHARGE TO DEEP COVE

The high annual rainfall (>7000 mm y<sup>-1</sup>) in the Fiordland region results in a well-defined surface layer of water that is low in salinity. In the Doubtful Sound complex, this layer is more pronounced due to the additional input of freshwater

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28 Lusseau, D., E. Slooten, J.E.S. Higham and S.M. Dawson. 2002. The effects of tourism activities on bottlenose dolphins in Fiordland: towards a sustainable solution. Department of Conservation, Wellington, New Zealand.

29 The pelagic zone is part of the open sea or ocean that is not near the coast or sea floor.

30 Boisseau, O.J. 2003. A summary of research conducted on the bottlenose dolphins of Fiordland, Department of Conservation, Southland Conservancy, Invercargill, New Zealand: 34;

Maersk Lusseau, S., S.R. Wing. Undated. Bottlenose dolphin diet in the New Zealand fiords: Importance of local production versus pelagic subsidies in the diet of an isolated population of bottlenose dolphins. University of Otago, Dunedin, New Zealand. 32 pp.

from the Manapouri hydroelectric power plant to Deep Cove (450 to 510 m<sup>3</sup> s<sup>-1</sup> on average).<sup>31</sup> This means that one-third of the freshwater input to the fiord complex is from natural rainfall and that the remaining two-thirds is from the input of freshwater at Deep Cove from the Manapouri power station.

The thickness of the low salinity layer ranges from 1 m at the entrance to the fiord to between 5 and 12 m at Deep Cove. Studies indicate that there are few organisms and lower abundance of key organisms in the inner Doubtful Sound/Patea region, where the low salinity layer is the thickest.<sup>32</sup> Although it is clear that the freshwater input into Deep Cove has an effect on the animal life, whether or not it has affected the dolphins' food source is unknown.

## DISEASE

Evidence of the bacterium *Brucella* was identified in a dead Maui's dolphin at the mouth of the Waikato River in November 2006. *Brucella* is a pathogen of terrestrial mammals that can cause late pregnancy abortion, and has been seen in a range of cetacean species. There is very little understanding of how this pathogen affects marine mammals.<sup>33</sup> It is important to monitor the population for signs of any contagion, because if a disease did affect this isolated population, it would have a drastic effect on the viability of these dolphins.

## GENE POOL

There is research currently underway examining the genetic subdivision between the three main inshore bottlenose dolphin geographic areas in New Zealand (Bay of Islands/Hauraki Gulf, Marlborough Sounds and Fiordland). This study is looking at genetic change on an evolutionary time frame, but the results will also inform current management. If populations from the three geographic regions have had interchanges of genetic material within a few generations, there is a greater likelihood of long-term resilience through gene flow. If the interchanges were restricted to hundreds or thousands of years ago there is greater concern for the long-term survival. This information will indicate the level of threat to the species and the vulnerability of individual populations when reduced to low numbers.

## CLIMATE VARIABILITY

Along with food supply, disease and genetics, climate change is a factor that could affect and may already be affecting the dolphin population. However, as with these other factors, there appears to be little that can be done on a micro-scale in the short term to combat this threat.

The effects of climate change have the potential to change the air and water temperature, altering the equilibrium in the Doubtful Sound complex. If the water temperature becomes inhospitable for the fish that dolphins prey on, the dolphins will be forced to another location or will face extinction.

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31 Rutger, S., S.R. Wing. 2006. Effects of freshwater input on shallow-water infaunal communities in Doubtful Sound, New Zealand. *Marine Ecology Progress Series* Vol. 314: 35-47 at 35.

32 Ibid. at 44.

33 DOC press release, 28 April 2007.

# Management Options

Given our knowledge of the threat to the dolphin population posed by vessel interactions, the precautionary principle leads us to taking active steps to reduce the negative effects. In practice, it will not be feasible to reduce this threat to zero: there must be a weighing-up between threats to the dolphins associated with human activities and the use and enjoyment of the Doubtful Sound complex. This section summarises possible options available in a chart with more extensive discussion of the various measures at the end.

The measures available can be broadly grouped into three categories:

- (a) creating different use zones in the Doubtful Sound complex;
- (b) reducing the overall boat traffic; and
- (c) improving behaviour around dolphins.

These management measures do not exist in isolation; in fact, we believe the best results will be achieved if a combination of these options is put into place.

(A) DIFFERENT USE ZONES	(B) REDUCING BOAT TRAFFIC	(C) IMPROVING BEHAVIOUR AROUND DOLPHINS
1. No-boat zones 2. Zones accessible by permit only 3. Zones where dolphin encounters may not be sought	4. Reducing commercial trip allocations 5. Limiting research activity 6. Permits/consents for non-commercial vessels	7. Increasing compliance measures 8. Restricting or encouraging radio contact re: dolphin location 9. Speed restrictions 10. Education of skippers and public

## A. DIFFERENT USE ZONES

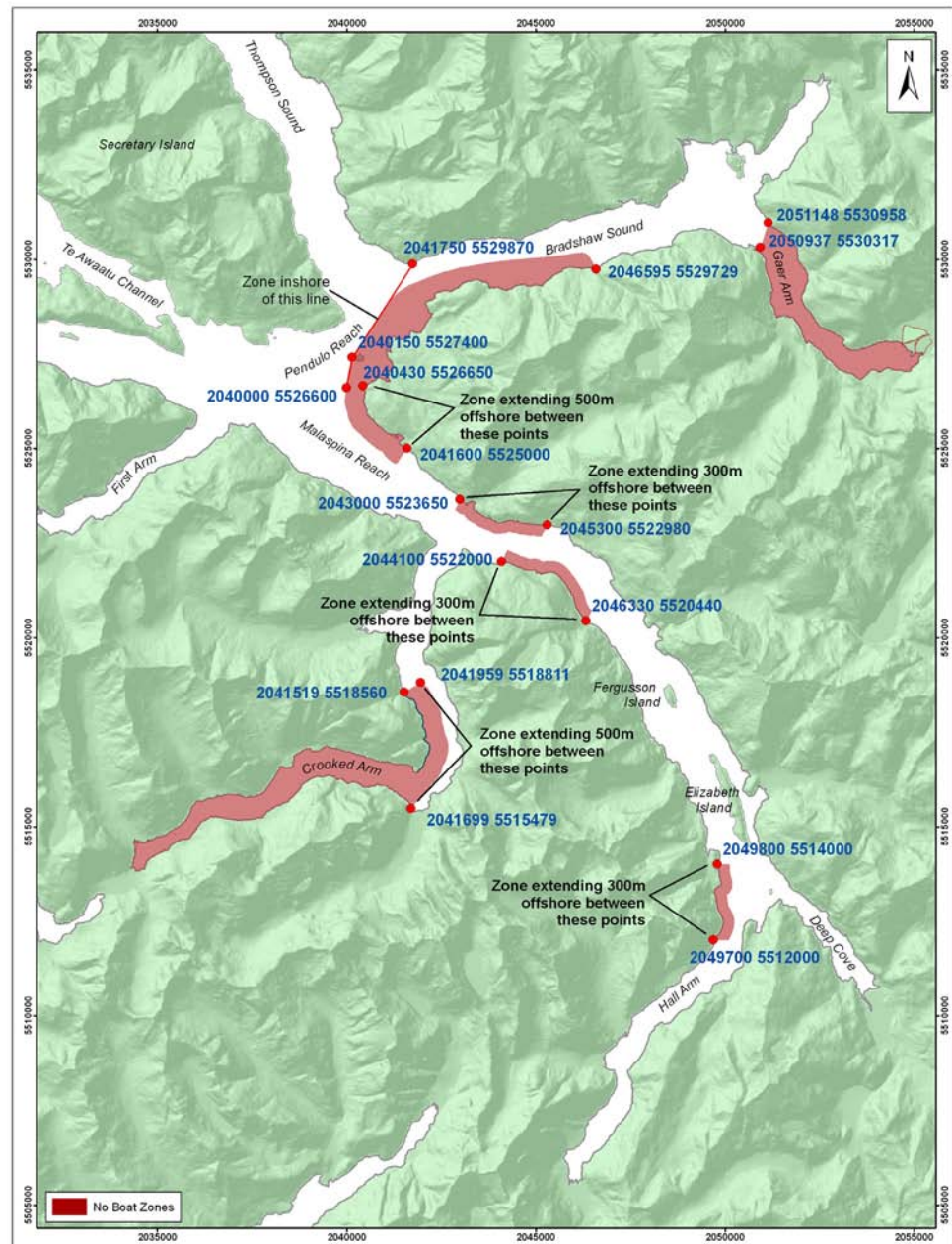
### 1. No-boat Zones

As discussed previously, the research designated certain areas in the Doubtful Sound complex as critical and important, depending on the amount of resting and socialising behaviour observed when dolphins were in those areas.

One option is to create zones or sanctuaries where, subject to navigation safety, no boats would have access. The areas where the most resting and socialising were observed were identified as critical. The biggest of these critical zones is Crooked Arm west of Turn Point. The other critical zones are found in Gaer Arm, the east shore of Bradshaw Sound and three strips along the shore of the main Doubtful Sound/Patea channel. Areas where resting and socialising were observed in significant but less frequent number were labelled as important.

Typically sanctuaries are established based on abundance information – that is, the raw number of sightings of a vulnerable species in a particular area. Sanctuaries based on abundance aim to protect locations with high concentrations of the species to decrease exposure to anthropogenic impacts. In a place like the Doubtful Sound complex, this would translate to restricting boat access in the entire complex, as dolphins are seen in most areas of the fiords. The existing research on dolphin behaviour means that protection of the dolphin population in the Doubtful Sound complex can be addressed more specifically with behavioural information.

Figure 6. Map showing bottlenose dolphin critical areas in the Doubtful Sound complex. *Source: DOC*



Areas where the dolphins are known to rest and socialise would be protected as these are the most critical for the population's survival. It is also widely held that dolphins are apt to learn where they will not encounter boats.

The dolphin population is most vulnerable in the winter months when the energy demands are the highest, particularly for pregnant and lactating mothers and their calves.<sup>34</sup> Within the sanctuary mechanism is the option to set aside sanctuaries on a seasonal basis and restrict boat access to certain areas during the colder months of the year.

<sup>34</sup> Lusseau, D. 2003. Male and female bottlenose dolphins *Tursiops* spp. have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. *Marine Ecology Progress Series* Vol. 257: 267-274 at 273.



## **Management Tools**

### ***Marine Mammal Sanctuary***

Section 22 of the Marine Mammal Protection Act 1978 allows the Minister of Conservation to establish marine mammal sanctuaries through notification in the *Gazette*. The sanctuary mechanism is flexible and a range of activities that may or may not be undertaken within the sanctuary may be specified, including restricting boat access. Another factor to consider is that the location of critical or important areas may change over time. This is not a serious impediment to creating a sanctuary as re-notification in the *Gazette* as to the boundaries of no-boat zones is not a complex procedure.

The Fiordland (Te Moana o Atawhenua) Marine Management Act 2005 established a marine reserve in Gaer Arm. The marine reserve status in Gaer Arm prohibits fishing but does not restrict boat access. Under the current laws, a marine mammal sanctuary cannot be declared in any marine reserve. Accordingly, if it is decided that limiting boat access to Gaer Arm is worthwhile, alternative measures to creating a no-boat zone will have to be explored.

### ***Plan Change***

The creation of a marine mammal sanctuary in the Doubtful Sound complex could occur in conjunction with a change to the Regional Coastal Plan for Southland. A plan change in this context would prohibit commercial surface water activity in the marine mammal sanctuary, but could take on a number of forms.

### ***Review of Consents***

A resource consent from Environment Southland is necessary in order to run a commercial operation in the Doubtful Sound complex. The process for obtaining a resource consent is governed by the Resource Management Act 1991 and the Regional Coastal Plan for Southland provides the parameters for the type and amount of surface water activity that can be considered in the Doubtful Sound complex.

There is presently no limit on the number of trips permitted to Doubtful Sound/Patea proper (the main channel) and Thompson Sound. However, the numbers of trips permitted to Bradshaw Sound and the arms of Doubtful Sound/Patea (Hall Arm, Crooked Arm, First Arm and Gaer Arm) are limited. These discretionary quotas are currently fully allocated.

A review of existing consents could be done in two ways. First, existing consent holders could voluntarily agree to change the parameters of their consents to protect critical dolphin habitat. Second, a review of consents could occur under section 128 of the Resource Management Act 1991 which prescribes the circumstances in which consent conditions can be reviewed.

### ***Enforcement***

The identification of critical and important zones for dolphins in the Doubtful Sound complex is the application of the raw research data adjusted to include a 400 m buffer. In practice, strict interpretation of the data would create boundaries that are confusing and difficult to recognise. In order to create sanctuaries with boundaries that are readily understood, it may be necessary to adjust the borders to make them identifiable to commercial and recreational boaters alike.

It would be possible to disseminate information about sanctuary boundaries to the commercial operators in Fiordland as these operators comprise a finite group. This is not the case for recreational boaters. It would be necessary to distribute information to boating clubs and to advertise in sporting magazines. It would also be helpful to have a map illustrating the zones where boats launch at Deep Cove.

### **National Examples**

Two marine mammal sanctuaries currently exist in New Zealand. The first, at Banks Peninsula, protects the breeding populations of Hector's dolphins. The sanctuary was established around Banks Peninsula because of a significant impact on the population due to individuals being entangled in gillnets and drowning. The sanctuary covers an area of 1170 km<sup>2</sup> from Sumner Head to the Rakaia River, out to a distance of 4 nautical miles. Within the sanctuary, set-netting is banned from November to the end of February and restrictions apply at all other times.

The second marine mammal sanctuary is found around the Auckland Islands. It protects breeding populations of the NZ (Hooker's) sea lion and the NZ subantarctic population of southern right whales.

### **International Example**

The Robson Bight (Michael Bigg) Ecological Reserve on Vancouver Island, Canada, was established in 1982 to protect orcas and their habitat.<sup>35</sup> The area (1248 ha) was designated a voluntary no-entry protected area. Programs were conducted to direct traffic on a voluntary basis away from the reserve.<sup>36</sup> The boundaries of the reserve are marked on nautical charts and there is a warden program. Additionally, the area is defined by two land-based boundary markers at the east and west ends. The area of prohibited access is a half nautical mile (approximately 1 km) offshore with an east and west offshore boundary running between these two points. Boundary violations by commercial whale watchers and commercial fishers are now rare. Sightings of commercial vessels within the sanctuary are rare.<sup>37</sup>

## **2. Zones accessible by permit only**

One way to reduce boat traffic while not eliminating access completely is to allow only Marine Mammal Viewing Permit holders in certain areas labelled as important for resting and socialising. Setting zones for exclusive access by tour operators with watching permits would restrict the number of dolphin-boat interactions in sensitive areas. It would also increase the value of a Marine Mammal Viewing Permit.

As discussed in relation to no-boat zones above, it would be important that the boundaries of any such zones were easy to identify.

The mechanisms for creating permit-only zones are similar to those for creating no-boat zones. The flexibility in the Marine Mammal Protection Act 1978 for establishing marine mammal sanctuaries allows for a range of permitted and non-permitted activities. If a multi-level sanctuary were established, the *Gazette* notice would specify the no-boat and permit-only zones.

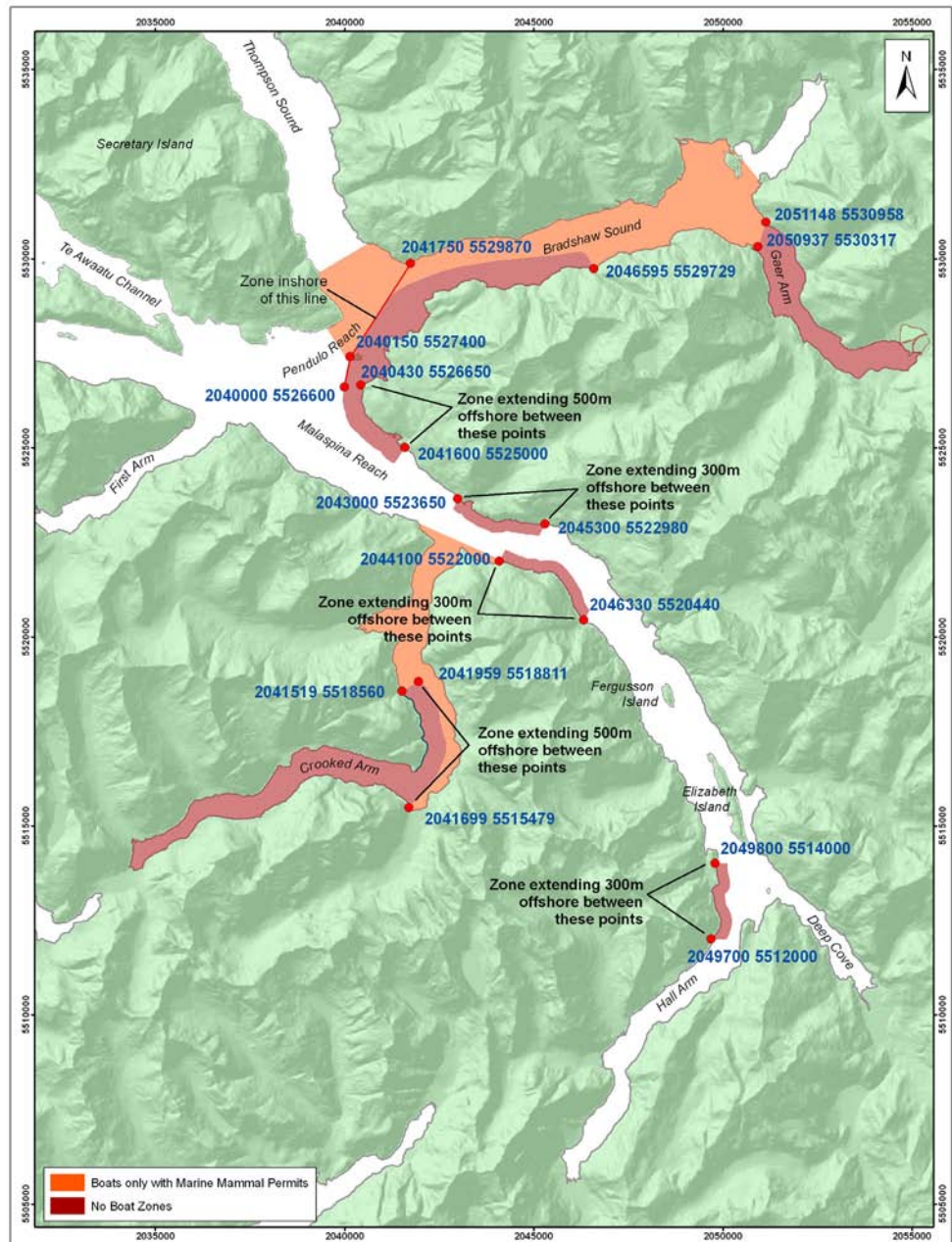
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35 [www.env.gov.bc.ca/bcparks](http://www.env.gov.bc.ca/bcparks).

36 Trites, A.W. et al. 2007. Boats displace killer whales from a marine protected area. Online: [www.iwcoffice.org](http://www.iwcoffice.org) (date accessed: 9 May 2007).

37 Ibid.

Figure 7. Map showing bottlenose dolphin critical and important areas in the Doubtful Sound complex.  
 Source: DOC



### 3. Zones where dolphin encounters may not be sought

When a school of dolphins is sighted from afar, vessels have the option to avoid a dolphin-boat interaction by not approaching the school. To avoid an interaction, it may be necessary for a boat to alter its course in order to give the school a wide berth. In other cases, the school may approach quite quickly, giving little or no time to adjust the course to avoid an interaction. The research has shown that dolphins will break from a school to interact with boats when a vessel is 400 m or less from the dolphins. The phrase ‘no sought encounter’ means that whenever possible, a vessel would avoid interacting with dolphins.

A mechanism such as this could be implemented in all or parts of the Doubtful Sound fiord complex. The benefits of such a measure are that the number of interactions would be reduced, as viewing permit holders presently do seek encounters. The difficulties with a ‘no sought encounters’ rule are that often an interaction cannot be avoided, as the dolphins are known to approach boats. Additionally, when there are waves, dolphins cannot be seen until they are very

close. In some respects this represents a compromise by allowing interactions when the dolphins seek them out, but not in any other case.

A 'no sought encounter' rule could exist in the form of a voluntary code of practice or could be entrenched in regulations.

## **B. REDUCING BOAT TRAFFIC**

### **4. Reducing commercial trip allocations**

The Regional Coastal Plan for Southland provides the parameters for the amount of commercial surface water activity that is permitted in the Doubtful Sound complex. There is no limit on the number of trips permitted to Doubtful Sound/Patea proper (the main channel) and Thompson Sound. However, the numbers of trips permitted to Bradshaw Sound and the arms of Doubtful Sound/Patea (Hall Arm, Crooked Arm, First Arm and Gaer Arm) are limited. Currently, these discretionary quotas have been fully allocated.

A change to the Regional Coastal Plan for Southland would have to occur in order to reduce the number of trips occurring in the Doubtful Sound complex. This could have the effect of reducing the number of trips currently permitted to the arms of Doubtful Sound/Patea. An additional measure would be to put a cap on the number of trips to the main channel of Doubtful Sound/Patea.

### **5. Limiting research activity**

Robust science is needed to assist the management of threats to dolphins in the Doubtful Sound complex. Some of the research has the potential to generate a threat to the dolphins. This reinforces the importance of undertaking assessment of management objectives, data requirements and the various options for gathering such data. Conducted appropriately, such a process can identify the best research options that balance these requirements with practicality and ethics.

Through a research vessel permitting process, it is possible to ensure that research being carried out does not cause any undue stress on the dolphins. Although research vessels may have an effect on dolphin behaviour, decreasing the amount of research conducted will impact the ability to make informed management decisions to protect the dolphins.

The Marine Mammal Protection Act 1978 requires that anyone who 'takes', or attempts to 'take' a marine mammal, whether alive or dead, requires a permit to do so. The definition of 'take' is very broad: it includes '...catch, kill, injure, attract, harass, disturb, possess, brand, tag, mark, separate part of carcass, or to attempt to do any of these things or similar things'.<sup>38</sup> Therefore any research that involves 'take' requires a scientific permit before any work is conducted. Any permit granted can at any time be amended, restricted or revoked with solid justification.

### **6. Permits/Consents for Non-Commercial Vessels**

Currently there are no limits to the number of recreational boats that can frequent the Doubtful Sound complex. The attraction of the fiord to private boaters is increasing and a permitting process would be one way to control the number

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<sup>38</sup> Marine Mammal Protection Act 1978, section 2.

of private vessels. Not only would a permitting process control the amount of recreational boating activity but it would also provide a forum to educate boaters. Education could be in the form of written information or a video seminar with a test to ensure boater knowledge of proper behaviour around marine mammals. Permits could be instituted through the Marine Mammal Protection Regulations 1992 as well as the Regional Coastal Plan for Southland.

## C. IMPROVING BEHAVIOUR AROUND DOLPHINS

### **7. Increasing compliance activity**

The Marine Mammal Protection Regulations 1992 provide conditions governing proper behaviour by commercial and all other persons around marine mammals. A summary of these conditions is listed in the legislation section, Appendix 2.

The enactment and promotion of these regulations has raised the level of awareness among commercial operators of proper behaviour around the dolphins. The Marine Mammal Protection Act 1978 allows for the promulgation of regulations relating to certain areas. There are several examples where regulations specific to the Doubtful Sound complex would increase protection of the dolphins. These will be discussed in more detail below. Two examples include the difficulty of avoiding dolphins in the narrow confines of the fiord as well as the difficulty of sighting dolphins from afar on days when there are waves. Regulations suited to the specific characteristics of the Doubtful Sound complex would benefit boaters and dolphins alike.

In order to ensure that existing or Doubtful Sound complex specific regulations are being followed by commercial operators and recreational boaters alike, increased measures could be taken to enforce compliance. These might include surveillance by the Department of Conservation, Environment Southland, Ministry of Fisheries and other management agencies that operate in the Doubtful Sound complex. Proper behaviour around the dolphins is an important part of keeping the disturbance caused to a minimum. Surveillance would work best in conjunction with education and mechanisms to decrease the number of interactions.

### **8. Restricting or encouraging radio contact re: dolphin location**

It is not uncommon for commercial operators to communicate the location of the dolphins by radio so that a dolphin sighting is ensured. Conversely, radio interactions prevent multiple boats from converging and interacting with the dolphins at the same time. There is an argument to be made that leaving dolphin sightings to chance would decrease the number of interactions, thus providing the dolphins with more protection.

Prohibiting radio contact could be done through enacting regulations specific to the Doubtful Sound complex or through a voluntary code of practice. Evading such a rule would not be difficult, however: switching channels or adoptive code language are easy ways around it. Operators would need to agree that leaving encounters to chance is a valuable measure. Conversely it could be mandatory including the time and location of the dolphin interaction such that boats could ensure that dolphins experienced at least 68 minutes between interactions as identified in section 7.E above.

## **9. Speed restrictions**

The existing code of practice mandates speed restrictions in certain scenarios unique to the Doubtful Sound complex. These have come about as a result of practical difficulties in implementing the Marine Mammal Protection Regulations 1992, which apply to all marine mammal viewing in New Zealand. It would be beneficial to put these measures in place for all users of the fiord, not just the parties to the code of practice, in the form of changes to the Regional Coastal Plan for Southland. The following are examples of how regulations specific to the Doubtful Sound complex and Fiordland would increase the effectiveness of protection measures:

1. Dolphins are generally visible from 300 m on a calm day. If there is chop on the water, which is common, dolphins may not be visible until a vessel is 100 m or closer. If visibility is less than 300 m, the vessel will immediately comply with all requirements from the time dolphins are sighted.
2. Due to the narrow confines of the fiord, it is sometimes difficult to avoid approaching the dolphins from head on, which is prohibited in the Marine Mammal Protection Regulations 1992. When this is the case, the vessel would reduce to no-wake speed and stop when within 100 m, allowing the dolphins to approach and pass the vessel.
3. Proceeding through a school can be unavoidable if the dolphins are spread out across the narrow part of the fiord. Where this is the case, low or no-wake vessel speed would be used to minimise disruption.

## **10. Education of skippers and public**

Awareness of the disturbance that vessels cause dolphins has increased in recent years. There is still room for dissemination of information on proper behaviour when around dolphins to both the public and the skippers of the boats in the Doubtful Sound complex.

Public education could be carried out through brochures and signposting at Deep Cove, as well as at Manapouri and Te Anau. Presentations to boating and sporting clubs and advertisements in sporting publications and newspapers would also increase awareness.

The commercial skippers who operate in the Doubtful Sound complex have a vast wealth of knowledge about Fiordland. Seminars conducted by respected experts in the marine mammal field would be beneficial to keep skippers up to date on the status of and proper behaviour around the dolphins. Because of the existing high knowledge level of the skippers, the instructors of such seminars should be highly qualified in the field. In addition, such forums would provide for the sharing of information on the natural and human activity in the Doubtful Sound complex. Because of the peak in tourist activity during the summer months, this type of education would be best conducted in the off-season on an annual or biannual basis. Educating the commercial operators' staff is a means of ensuring the public are informed of the issues surrounding the dolphin population.

# Conclusion/Next Steps

This discussion document summarises some of the issues the Department of Conservation is aware of at this stage and canvasses several of the available management options for the bottlenose dolphins in the Doubtful Sound complex. Given the threat of extinction, it is considered that whatever mechanisms are put in place (recognising that more than one mechanism may be necessary) must be put in place swiftly and must offer a high degree of protection.

The Department of Conservation is committed to both increasing knowledge of the threats to the dolphin population and monitoring any measures implemented to ensure effectiveness. In the event that the measures adopted in the short term are not increasing the population's viability, more protective measures will need to be considered.

A summary of the process is as follows:

- Consultation with key stakeholders
- Public notification of this discussion document
- Public feedback - by Wednesday 5 September 2007
- Analysis of public comments
- Recommendation
- Decision

## Over to You

The Department of Conservation encourages you to make suggestions in order to help develop an informed strategy to address the decline in the bottlenose dolphin population in the Doubtful Sound complex. A number of interest groups and people have already indicated their interest in this process. The Department of Conservation appreciates and acknowledges their contributions and seeks further input from all interested parties.

For further information on any aspect of this document or on how to be involved, call the Department of Conservation, Southland Conservancy by phoning (03) 211 2465 or emailing [cwilliams@doc.govt.nz](mailto:cwilliams@doc.govt.nz).

Further copies of this document and the attached feedback form are available from Department of Conservation offices in Oban, Invercargill and Te Anau and from [www.doc.govt.nz](http://www.doc.govt.nz).

Please send your suggestions on the accompanying form by 5 September 2007.

# Appendix 1: Management Options Assessment

In the chart below, each of the management options discussed is assessed on the basis of several factors:

- **Area Protected.** Some measures will increase the protection of the dolphins throughout the Doubtful Sound complex while others apply to a specific area. Other measures such as education will increase the protection of marine mammals throughout New Zealand coastal waters.
- **Enforcement.** It is recognised that the remote nature of the Doubtful Sound complex makes compliance monitoring largely impractical. Accordingly, the effectiveness of a management option is closely related to the amount of enforcement necessary to make the measure useful.
- **Management tool.** The statutory or non-statutory means necessary to put a measure in place.
- **Time frame to put in place.** A key factor when assessing the effectiveness of an option is how long it will take to implement. The options on the chart are assessed on whether they can be put in place in the short term (months), medium term (months to one year) or long term (over one year).
- **Advantages and disadvantages.** The predominant benefits and drawbacks of each option.
- **Level of protection.** Whether an option offers a low, medium or high degree of protection to the dolphins.

Abbreviations used in chart:

- RMA - Resource Management Act 1991
- MMPA - Marine Mammal Protection Act 1978
- MMPR - Marine Mammal Protection Regulations 1992
- MMVP - Marine Mammal Viewing Permit



(A) DIFFERENT USE ZONES

OPTION	AREA PROTECTED	ENFORCEMENT	MANAGEMENT TOOL	TIME FRAME TO PUT IN PLACE	ADVANTAGES	DISADVANTAGES	LEVEL OF PROTECTION
1. No-boat zones	- all or parts of critical areas	- strict scientific boundaries would be difficult to enforce	- sanctuary (MMPA, MMPR)  and/or  - RMA	-Sanctuary under MMPA/MMPR: medium term  - plan change under RMA: long term	- sets aside boat-free areas for dolphins	- re-notification of no-boat areas may be necessary if critical areas change over time  - restricts use of some areas to boats  - compliance activities are costly	- high
2. Zones accessible by permit only	- all or parts of important areas	- strict scientific boundaries would be difficult to enforce	-MMVP (via MMPA, MMPR)	- sanctuary under MMPA/MMPR: medium term  - plan change under RMA: long term	- allows access to some boats - adds value to MMVP	- re-notification of no-boat areas may be necessary if critical areas change over time  - compliance activities are costly	- medium
3. Zones where dolphin encounters may not be sought	- all or part of critical areas  and/or  - all or part of important areas	- self-policing	- MMPR  and/or  voluntary code of practice	- MMPR: medium term  - voluntary code of practice: short term	- decreases amount of time dolphins spend with boats	- does not prevent scenario where dolphins break from school to interact with group  - decreases value of MMVP	- low/ medium

(B) REDUCING BOAT TRAFFIC

OPTION	AREA PROTECTED	ENFORCEMENT	MANAGEMENT TOOL	TIME FRAME TO PUT IN PLACE	ADVANTAGES	DISADVANTAGES	LEVEL OF PROTECTION
4. Reducing commercial trip allocations	- all of the Doubtful Sound complex	- resource consent enforcement	- RMA	- long term	- decrease in number of trips permitted would de facto decrease the number of interactions possible	- potential to negatively impact upon existing operators' businesses  - unless voluntary, review of consent could take a number of years if appealed	- high
5. Limiting research activity	- all of the Doubtful Sound complex	- resource consent enforcement	- RMA and/or - MMPR	- short term	- decreases number of dolphin-boat interactions	-decreases knowledge acquisition of dolphin population	- low
6. Permits/consents for non-commercial vessels	- all of the Doubtful Sound complex	- resource consent enforcement	- RMA and/or - MMPR	- medium/long term	- allows control of numbers of vessels in - all of the Doubtful Sound complex as location increases in popularity  - sufficient knowledge of behaviour around marine mammals as precondition to permit/consent would improve behaviour around dolphins	- reduces ease of public access to all of the Doubtful Sound complex	- low/ medium

(C) IMPROVING BEHAVIOUR AROUND DOLPHINS

OPTION	AREA PROTECTED	ENFORCEMENT	MANAGEMENT TOOL	TIME FRAME TO PUT IN PLACE	ADVANTAGES	DISADVANTAGES	LEVEL OF PROTECTION
7. Increasing compliance measures	- all of the Doubtful Sound complex	- DOC and/or Environment Southland vessels	MMPR	- medium term	- ensures that vessels are complying with MMPR - creates regulations specific to the Doubtful Sound complex	- compliance activities are costly	- medium
8. Restricting or encouraging radio contact re: dolphin location	- all of the Doubtful Sound complex	- re: restricting: evasion possible through switching channels  - re: encouraging: difficult to enforce	- MMPR  - voluntary code of practice	- MMPR: medium term  - voluntary code of practice: dependent on reaching consensus	- re: restriction: leaves dolphin-boat interaction to chance and reduces possibility of school being passed off between boats  - re: encouragement: coordinates dolphin-boat interactions to acceptable frequencies	- re: restrictions: unable to coordinate boat traffic so that back to back interactions can be avoided  - re: encouragement: difficult to enforce.	- medium
9. Speed restrictions	- all or part of critical areas; and/or - all or part of important areas	- difficult to enforce	- MMPR - RMA - voluntary code of practice	- MMPR: medium term	- reduces dolphin disturbances	- difficult to enforce unless self-policing successful	- low/ medium
10. Education of skippers and public	- all of the Doubtful Sound complex - NZ coastal waters	- no enforcement issues	- no statutory basis required	- short term	- increased awareness could result in improved behaviour during dolphin encounters	- time consuming  - changes in skippers necessitates re-education	- low/ medium

# Appendix 2 - Explanation of Legislation

This section explains the main statutes that relate to protection of the Doubtful Sound bottlenose dolphin population.

## A. MARINE MAMMAL PROTECTION ACT 1978

All marine mammals are protected under the Marine Mammal Protection Act 1978. The purpose stated in the short title of this Act is to make provision for the protection, conservation and management of marine mammals within New Zealand territorial and fisheries waters. The Department of Conservation administers this Act. The Marine Mammal Protection Act 1978 enables the Department of Conservation to establish marine mammal sanctuaries.

The Marine Mammal Protection Act 1978 must be interpreted and administered so as to give effect to the principles of the Treaty of Waitangi.

## B. MARINE MAMMAL PROTECTION REGULATIONS 1992

The Marine Mammal Protection Regulations 1992 were established to manage commercial viewing of marine mammals. The regulations prescribe that any commercial operator, where a purpose is to view or come into contact with marine mammals, must have a Marine Mammal Viewing Permit. Permits are issued by the Department of Conservation.

The Director-General of Conservation shall not issue a permit unless he or she is satisfied that the proposal “will not have or be likely to have any adverse effect on the conservation, protection and management of marine mammals”.<sup>39</sup>

The Marine Mammal Protection Regulations 1992 also provide specific rules governing behaviour of all persons, including commercial operators, around marine mammals. In summary, these include the following:

- No vessel shall proceed through a school of dolphins.
- A vessel shall approach a dolphin from the direction that is parallel to the dolphin and slightly to the rear.
- Vessels should not be operated to disrupt the normal movement or behaviour of any marine mammal.
- Contact with a marine mammal shall be abandoned if it becomes or shows signs of becoming disturbed or alarmed.
- No person shall cause a marine mammal to be separated from a group, or cause members of a group to become scattered.
- There shall be no sudden or repeated change in the speed or direction of any vessel.
- When within 300 m of a marine mammal, a vessel shall move at the speed of the slowest marine mammal or at idle.

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<sup>39</sup> Marine Mammal Protection Regulations 1992, section 12(3)(a).

- A vessel leaving the vicinity of any marine mammal shall proceed at idle until at least 300 m. The vessel may exceed idle in order to outdistance the marine mammal but must increase speed gradually.

The Director-General of Conservation may suspend, revoke, amend or restrict any permit if the operator fails to comply with the regulations regarding behaviour around marine mammals.<sup>40</sup>

## C. THE RESOURCE MANAGEMENT ACT 1991

The purpose of the Resource Management Act 1991 is to promote the sustainable management of natural and physical resources. This includes the protection of areas of significant habitats of indigenous fauna. In the Doubtful Sound complex, a resource consent issued under the Act is necessary in order to conduct any commercial surface water activity. In Fiordland resource consents are administered by the regional council, Environment Southland.

A resource consent will only be granted if the proposed activity is consistent with the purposes and principles of the Resource Management Act 1991, namely promoting the sustainable management of natural and physical resources. This includes 'avoiding, remedying, or mitigating any adverse effects of activities on the environment'.<sup>41</sup>

The Resource Management Act 1991 provides for a hierarchy of policy statements and plans to guide resource management activities and decision making. The two that are most relevant to the management of the Doubtful Sound complex are the New Zealand Coastal Policy Statement and the Regional Coastal Plan for Southland.

### (i) New Zealand Coastal Policy Statement (NZCPS)

National policy statements enable central Government to prescribe objectives and policies on resource management matters of national significance. The *NZCPS* provides policy direction for the management of the coastal environment. Of particular relevance to the management of the Doubtful Sound dolphins is Policy 1.1.2 which states that it is a national priority for the preservation of the natural character of the coastal environment to protect areas containing "nationally outstanding examples of indigenous community types."<sup>42</sup> The bottlenose dolphins in the Doubtful Sound complex are a prime example of this type of population.

The *NZCPS* advocates a precautionary approach in Policy 3.3.1 "because there is a relative lack of understanding about coastal processes and the effects of activities on coastal processes."<sup>43</sup> Achieving sustainable management of the coastal area shall be undertaken while recognising the importance of maintaining public access to the coastal marine area.<sup>44</sup>

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<sup>40</sup> Marine Mammal Protection Regulations 1992, section 13(2).

<sup>41</sup> Resource Management Act 1991, section 5.

<sup>42</sup> New Zealand Coastal Policy Statement 1994, Policy 1.1.2(a)(ii).

<sup>43</sup> Ibid, Policy 3.3.1.

<sup>44</sup> Ibid, Policy 3.5.

## **(ii) Regional Coastal Plan for Southland (RCPS)**

Regional Plans assist regional councils in carrying out their functions under the Resource Management Act 1991 and may contain rules controlling the use of resources. Chapter 16 of the *RCPS* deals with surface water activities in the internal waters of Fiordland from Yates Point to Puysegur Point, which encompasses the Doubtful Sound complex. The chapter sets out restrictions on the extent and number of commercial activities to occur in the Doubtful Sound complex.

Under the *RCPS*, all research vessels require a permit, except when they are assessing the effects of activities of an operation for the purposes of a resource consent application.<sup>45</sup>

## **D. FIORDLAND (TE MOANA O ATAWHENUA) MARINE MANAGEMENT ACT 2005**

The entire Fiordland area is under a new marine management model legislated by the Fiordland (Te Moana o Atawhenua) Marine Management Act 2005 (the “Act”) and associated changes to fisheries regulations. The Fiordland Marine Guardians were established by the Act to ensure community input into the management of the area.

The Act includes a statutory mandate to implement measures to assist in the preservation, protection and sustainable management of the marine environment and biological diversity of the Fiordland (Te Moana o Atawhenua) Marine Area.

The Act also established eight marine reserves in Fiordland. Two of these are found in the Doubtful Sound complex. These are the Kutu Parera (Gaer Arm) and Taipari Roa (Elizabeth Island) marine reserves. Te Awaatu Channel (The Gut) marine reserve pre-existed the Act. Boat traffic is permitted in reserves, but fishing is prohibited.

## **E. NGAI TAHU CLAIMS SETTLEMENT ACT 1998**

The Fiordland coastal area, which includes the Doubtful Sound complex, is a statutory acknowledgment area under the Ngai Tahu Claims Settlement Act 1998. Fiordland holds special significance for Ngai Tahu.<sup>46</sup>

## **F. NON-STATUTORY MECHANISMS: CODES OF PRACTICE**

A voluntary code of practice has been developed in conjunction with marine mammal tourism operators in Fiordland. The code is promoted amongst other tourist operators, recreational boaters and commercial fishers and prescribes specific behaviour around marine mammals.

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<sup>45</sup> Regional Coastal Plan for Southland, Rule 16.2.2.

<sup>46</sup> Ngai Tahu Claims Settlement Act 1998, sections 205-222.

# Glossary of Terms

**Benthic:** The benthic zone is the lowest level of a body of water, such as an ocean or a lake. It is inhabited by organisms that live in close relationship with (if not physically attached to) the ground, called benthos or benthic organisms.

**Cetacean:** A member of the order of animals that includes whales, dolphins and porpoises.

**Precautionary principle:** A willingness to take action in advance of scientific proof of the need for the proposed action on the grounds that further delay will prove ultimately detrimental to society and nature, and, in the longer term, selfish and unfair to future generations.

**The Doubtful Sound complex:** Includes Deep Cove, Hall Arm, Crooked Arm, First Arm, Bradshaw Sound, Gaer Arm, Thomson Sound and Doubtful Sound/Patea.

## Literature Cited

- Bejder, L. 2005. Linking short- and long-term effects of nature-based tourism on cetaceans. PhD thesis, Dalhousie University, Halifax.
- Brager, S., K. Schneider. 1998. Near-shore distribution and abundance of dolphins along the west coast of the South Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* Vol. 32: 105-112.
- Boisseau, O.J. 2003. A summary of research conducted on the bottlenose dolphins of Fiordland, Department of Conservation, Southland Conservancy, Invercargill, New Zealand: 34.
- Currey, R. 2006. Cetacean sightings off the Fiordland coastline. University of Otago, Dunedin, New Zealand. 52pp.
- Haase, P., K. Schneider. 2001. Birth demographics of bottlenose dolphins, *Tursiops truncatus*, in Doubtful Sound, Fiordland, New Zealand – preliminary findings. *New Zealand Journal of Marine and Freshwater Research* Vol. 35: 675-680.
- Higham, J.E.S., D. Lusseau. Undated. Ecological impacts and management of tourist engagements with marine mammals. University of Otago, Dunedin, New Zealand.
- Higham, J.E.S., D. Lusseau. 2003. Managing the impacts of dolphin-based tourism through the definition of critical habitats: the case of bottlenose dolphins (*Tursiops* spp.) in Doubtful Sound, New Zealand. *Tourism Management* Vol. 25: 657-667.
- Lusseau, D., S. Maersk Lusseau, L. Bedjer and R. Williams. Undated. An individual-based model to infer the impact of whale watching on cetacean population dynamics. 19pp.
- Lusseau, D., E. Slooten and R. Currey. Undated. Unsustainable dolphin-watching tourism in Fiordland, New Zealand. *Tourism in Marine Environments* *in press*.
- Lusseau, D., E. Slooten, J.E.S. Higham and S.M. Dawson. 2002. The effects of tourism activities on bottlenose dolphins in Fiordland: towards a sustainable solution. Department of Conservation, Wellington, New Zealand.
- Lusseau, D., K. Schneider, O.J. Boisseau, P. Haase, E. Slooten and S.M. Dawson. 2003. The bottlenose dolphin community of Doubtful Sound features a large proportion of long-lasting associations – Can geographic isolation explain this unique trait? *Behavioural Ecology and Sociobiology* 54(4): 396-405.
- Lusseau, D. Undated. Directions in the scientific aspects of whale watching management. Presentation at Science for Sustainable Whale Watching Workshop, organised by the IWC. 8pp.

- Lusseau, D. 2003. Effects of tour boats on the behaviour of bottlenose dolphins: using Markov chains to model anthropogenic impacts. *Conservation Biology* Vol. 17, No. 6: 1785-1793.
- Lusseau, D. 2003. Male and female bottlenose dolphins *Tursiops* spp. have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. *Marine Ecology Progress Series* Vol. 257: 267-274.
- Lusseau, D. 2003. The state of the scenic cruise industry in Doubtful Sound in relation to a key natural resource: bottlenose dolphins. In: *Nature-based tourism in peripheral areas: development or disaster?* (Edited by M. Hall and B. Boyd). Channelview Publications, Cleventon, England.
- Lusseau, D. 2004. The hidden cost of tourism: detecting long-term effects of tourism using behavioural information. *Ecology and Society* 9(1): 2
- Lusseau, D. 2005. Residency patterns of bottlenose dolphins *Tursiops* spp. in Milford Sound, New Zealand is related to boat traffic. *Marine Ecology Progress Series* Vol. 295: 265-272.
- Lusseau, D. 2006. The short-term behavioural reactions of bottlenose dolphins to interactions with boats in Doubtful Sound, New Zealand. *Marine Mammal Science*.
- Maersk Lusseau, S., S.R.Wing. Undated. Bottlenose dolphin diet in the New Zealand fiords: Importance of local production versus pelagic subsidies in the diet of an isolated population of bottlenose dolphins. University of Otago, Dunedin, New Zealand. 32 pp.
- Reeves, R. 1992. Whale responses to anthropogenic sounds: a literature review. *Science and Research Series Number 52*. Department of Conservation, Wellington, New Zealand.
- Rutger, S., S.R. Wing. 2006. Effects of freshwater input on shallow-water infaunal communities in Doubtful Sound, New Zealand. *Marine Ecology Progress Series* Vol. 314: 35-47.
- Schneider, K. 1999. Behaviour and ecology of bottlenose dolphins in Doubtful Sound, Fiordland, New Zealand. PhD thesis, University of Otago, Dunedin, New Zealand. 211 pp.
- Williams, J.A., S.M. Dawson and E. Slooten. 1993. The abundance and distribution of bottlenose dolphins *Tursiops truncatus* in Doubtful Sound, New Zealand. *Canadian Journal of Zoology* 71: 2080-2088.

## ONLINE SOURCES

[www.env.gov.bc.ca/bcparks](http://www.env.gov.bc.ca/bcparks)

'Long-Term Sustainability Central to Monkey Mia Decision' 26 June 2006: [www.mediastatements.wa.gov.au](http://www.mediastatements.wa.gov.au)

Trites, A.W. et al. 2007. Boats displace killer whales from a marine protected area. Online: [www.iwcoffice.org](http://www.iwcoffice.org) (date accessed: 9 May 2007).







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